

NAVAL POSTGRADUATE SCHOOL MONTEREY, CALIFORNIA



THESIS

**OVERHEAD RATES FOR THE
PUBLIC WORKS OFFICE
AT THE NAVAL POSTGRADUATE SCHOOL**

by

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December, 1995

Thesis Advisor:

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AT THE NAVAL POSTGRADUATE SCHOOL**

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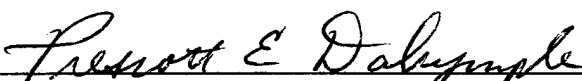
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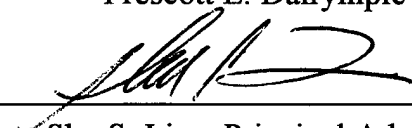
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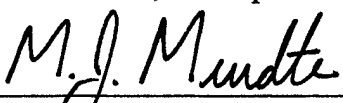
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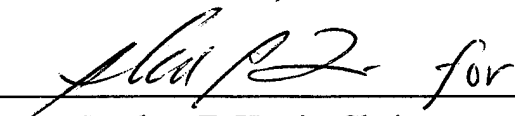
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ABSTRACT

This thesis develops unit cost overhead rates for the services provided to the customers of the Public Works Office at the Naval Postgraduate School. All of the costs necessary to operate the Public Works Office were collected and defined as either direct or indirect costs. Cost pools were then established to allow proper allocation of the indirect costs with respect to their individual cost drivers. Overhead rates were then established that would allow the Public Works Office to recover an equitable share of their overhead costs from their reimbursable customers.

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I. INTRODUCTION

A. BACKGROUND

In 1994, the Public Works Office at the Naval Postgraduate School in Monterey, CA began performing public works functions for the Army's Presidio of Monterey (POM) and the Presidio of Monterey Annex (POMA) on a cost reimbursable basis. In addition, the number of other reimbursable customers increased significantly. Since the majority of PWO functions performed previous to 1994 had been primarily for the Naval Postgraduate School (NPS), it had never been necessary to determine the overhead costs of operating the PWO. The few Navy tenants that were served on a reimbursable basis were only charged on a direct cost basis. These reimbursable costs were less than five percent of the PWO budget and the associated overhead costs were not considered significant relevant to the total overhead costs.

With the additional work from the Army and other reimbursable customers, which now exceeds the NPS workload, proper recovery of overhead costs is essential. Currently, the indirect billets required must be determined individually for each customer for each division within PWO. Establishing overhead rates will allow PWO to analyze workload versus billets in each functional area on an aggregate basis.

For example, if additional billets are required in the Administrative Division to meet the workload, those billets can be established and the overhead rate adjusted accordingly without regard to which customer is responsible for the additional workload, since the cost driver used to establish the overhead rate will properly allocate the overhead

cost among the various customers. Therefore, the establishment of overhead rates will greatly simplify the management of personnel resources.

This benefit will take on additional significance when one examines the current relationship between workload and resources. Currently, when the workload exceeds the available resources, the backlog of work increases since the capacity of PWO to execute work is fixed by the number of billets. Even when customers have funding in hand, they must wait in the queue for their job to percolate to the top. Unit costing for overhead will greatly aid the ability of PWO to increase capacity since it will preclude the requirement to determine the source of funding for each overhead billet individually.

The Public Works Officer requested that this thesis determine appropriate overhead rates for the reimbursable services that PWO performs for its customers. The results of this thesis will then be used to determine whether the reimbursable customers are paying their fair share of the PWO overhead costs or if new rates for the services performed should be established.

B. OVERHEAD ALLOCATION METHODS

The most fair method of charging a customer for services rendered is to account for every single cost item as a direct cost. However, it would be very difficult to account for the two minutes that a clerk spends recording the request, the three sheets of paper used and the ink required. The concept of overhead is one of determining pools of costs for which it is not cost efficient to track direct costs. These overhead pools costs are then distributed over all of the cost objectives. The clerk's salary is spread out over all of the

jobs she processes, and the cost of all the sheets of paper and ink are allocated to each cost objective.

The challenge in determining overhead pools is to balance precision and complexity with ease of use and fairness to all of the customers. This includes determining which cost driver should be used to distribute overhead costs. One customer may use more direct materials than another but far less direct labor hours. Therefore, depending upon the driver is to determine overhead allocation, the customer may pay a larger or smaller share of the overhead costs. Ideally, the cost driver should be linked to the overhead cost. If the Public Works Officer spends a prominent portion of time working on labor related issues, it may be more appropriate to use direct labor hours to allocate him as overhead.

Once again, it might be more fair to use multiple cost drivers for allocation purposes, however, the cost of tracking the indirect costs may quickly overshadow the benefit of doing so. Therefore, decisions have to be made as to what cost drivers will be used to be most fair to the customers, but to also allow ease of use for tracking costs and determining rates.

Determining the most appropriate cost drivers for basing PWO overhead is particularly difficult as there is a wide range to choose from and often very little relation between different drivers. The following examples demonstrate the units used for direct costs that PWO charges its customers: electricity based on kilowatt hours, pest and weed control based on man-hours, refuse and trash service on a cubic yard basis, engineering

design services based on the estimated cost of construction, and facilities support contracts based on the amount of the contract.

Accuracy of the overhead rate determination is also critical, to avoid double accounting costs and thus overcharging for overhead. This often occurs when accounting for some of the direct costs that comprise the G&A pool, and then including the G&A overhead rate in that direct cost. For example, if vehicles were billed at \$500 a year plus 1% of costs for G&A, then a pickup would cost the customer \$505. If the G&A pool also included four pickups billed at \$505 a piece, that would in turn raise the G&A rate by double counting. The calculation of overhead rates must be careful to ensure that costs are not double counted.

C. DEFINITIONS

It is critical to ensure that the definitions of many of the terms are commonly understood. Otherwise, terms will be misunderstood and misapplied, as various entities frequently ascribe their own definitions. For example, the terms general and administrative (G&A) and overhead and indirect costs are frequently considered to be three synonymous terms, although they may carry three separate and distinct meanings, such as when used on a government estimate for a construction contract modification.

The following section will define several significant terms as they will be used in the context of this thesis. The illustration in Figure 1 should help visualize the relationship between these terms.

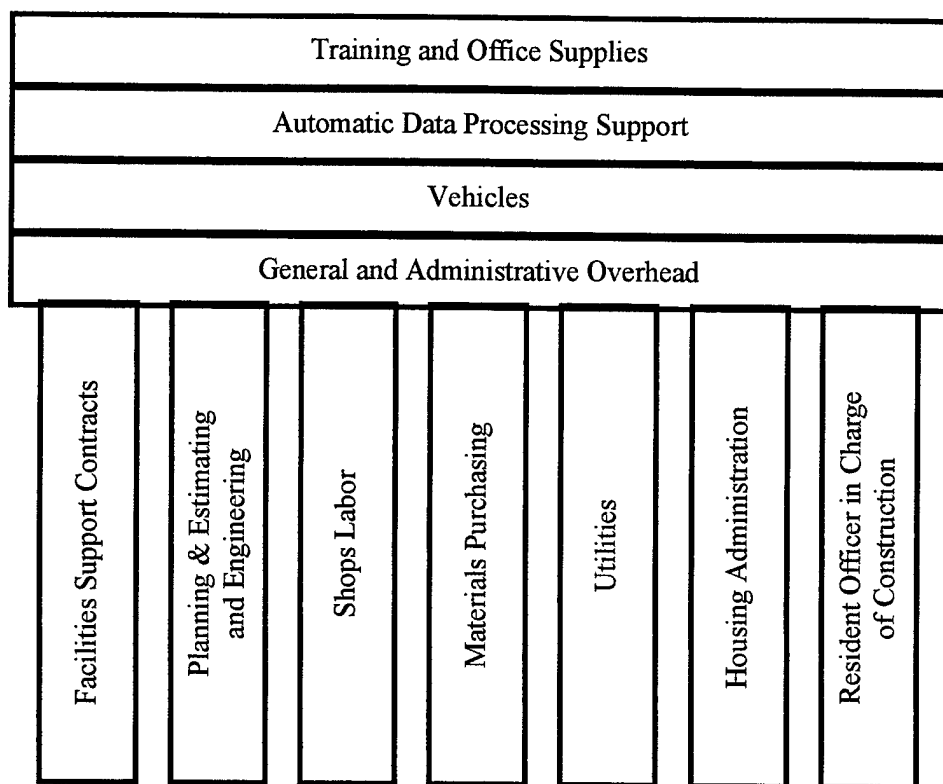


Figure 1 Allocation of PWO Costs

In a generic sense, cost is anything of value, and in the accounting world the word is usually modified with another term to identify it. This thesis will use the term costs as the value of dollars that must be paid. Costs may be paid by the customer to PWO or by PWO to it's suppliers and employees. Items that are not assigned dollar values and for which no money is expected will not be considered in this thesis.

A cost objective will be defined as any service, product, project, activity or function that PWO performs for its customers, and the objective for which the cost of providing the service is accumulated. [Such as when pest control spends four hours debugging a classroom, or when POM consumes 600 mega watt hours of electricity in a month].

To allocate is to assign various costs to a cost objective.

Direct costs are all necessary costs that can be specifically identified and allocated to the accomplishment of a cost objective. [The costs of the labor for two men to spray the room and the costs of the bug spray are direct costs. The electricity itself has a cost as defined by the local power company that provides it.]

Overhead is any cost that cannot be directly traced to a specific cost objective and yet is necessary for the accomplishment of that cost objective. Within this thesis, indirect costs will be considered to be the same as overhead costs. [The inspector who stops in to ensure that the room has been sprayed is an overhead cost, as well as the supervisor of the two men, that supervisor's boss and so on up to the Public Works Officer. The electrical lines within the base that provide the power and the clerk who calculates the Army's bill are examples of overhead costs.]

The cost drivers are the activities or functions that most directly influence the indirect cost associated with the direct cost. For example, the overhead cost associated with family housing management is driven primarily by the number of housing units in the inventory. Note that the cost driver alone does not determine the mathematical relationship between the direct costs and overhead costs, i.e., the overhead cost of managing 2,500 units is probably not five times the cost of managing 500 units. This relationship must be determined in a separate step.

Note that a cost item may often have more than one cost driver. For example, the overhead required to award and administer contracts is driven by not only the number of contracts by their dollar value as well. Certain actions such as opening of bids are

required regardless of whether the contract is \$25,000 or \$25 million, while other actions such as inspection effort is tied closely to the dollar value of the contract.

An overhead pool is a collection of overhead costs that cannot be directly traced to a cost objective. Notice that there may be several overhead pools identified with a single cost objective. General and administrative costs are a particular overhead pool, typically the one at the top of the pyramid, and which typically must be allocated to all other costs. [The trucks that transported the pest control men to the site and the gasoline used are part of the vehicle overhead pool that must be allocated. The clerk one of many who perform administrative work in the main office and are part of an overhead pool called G&A.]

The overhead rate defines the relationship between the direct costs and the overhead. This is typically a mathematical relationship, and may be shown as a percentage or as a dollar figure. [Since the supervisor is in charge of eight personnel altogether, one fourth of his costs are assigned as the overhead rate relating his efforts to the two pest controllers. The clerk spends two hours out of a months 160 hours, so one eightieth of the clerks costs are included in the overhead rate billed to the Army for the electricity.]

Reimbursable costs are costs expended by an entity that will be billed to another entity. The term implies that not all costs incurred by the performing activity will be passed onto the customer. Currently, PWO does not get reimbursed for work performed for NPS, while the tenant commands have only reimbursed PWO for the direct costs.

As opposed to a budget, in which the Public Works Officer would be able to control how funds were spent, the PWO has a workload. This consists of all of the costs that PWO spends, whether for direct labor, supplies, or reimbursed utilities.

D. THESIS METHODOLOGY

This thesis will develop a model that will define the overhead rates based on certain assumptions. The intent is to make the model flexible so that as future Public Works Officers are faced with different circumstances and have to make different assumptions, they can easily adjust the model to determine the new overhead rates.

To accomplish this task, this thesis will focus on two basic areas: collection and analysis of the cost data, and analysis and justification for the assumptions that comprise the overhead pools and corresponding overhead rates. The initial part of the research will involve identifying and accounting for all of the costs necessary to operate the PWO. These costs will then be categorized as either overhead or direct costs, with a further distinguishing of the separate overhead pools. Using this data, the overhead rate for each overhead pool will be calculated.

Finally, a sensitivity analysis will be performed to determine the effect of errors made in the assumption process. This will allow the PWO to make necessary corrections in the future recalculations to account for over collection or under collection of overhead costs.

II. CLASSIFICATION OF COSTS

A. INTRODUCTION

This portion of the thesis will classify all of the costs necessary for operating the NPS PWO as planned for fiscal year 1996. Assumptions will be identified and corresponding rationale for the decisions made will be justified. The data available is based on actual costs from the 1995 workload and the projected 1996 budget. Using two different years data may be the source of some errors in the calculations, because of differing workloads, although the sensitivity analysis in Chapter V suggests that the effect is insignificant. However, the assumptions and costs used to derive the overhead rates of this thesis should be reviewed and updated annually to ensure accuracy.

Initially, cost pools and associated components will be established and justified, which will account for every cost in the PWO workload. After cost drivers have been determined, the allocation methods will reduce the number of relevant cost pools to only include pools with reimbursable cost elements. The sum of the totals of each of these costs pools should equate to the sum of the costs of the remaining pools, after all of the allocation processes have happened.

For example, the G&A pool will be established initially, and a cost driver identified to allocate the G&A costs to other pools. Once it is completely allocated, the pool is no longer relevant and effectively can be ignored. Only the relevant cost pools will remain, and they will include costs allocated from the G&A pool.

Finally, each identified cost element will be classified as either a direct or an overhead cost and then grouped into the appropriate pool. At this point, it becomes obvious that there is a point of diminishing returns as to determining the level of detail with which to trace each cost element. Labor could be recorded in days, hours, minutes or seconds, but it is generally accepted that hours is the most cost efficient method for direct costing purposes. Furthermore, it is recognized that it is not physically feasible to trace some costs such as office supplies (paper, pens, paperclips, etc.) and thus it is most logical to group all of these costs into an overhead pool.

B. COST POOLS

After roughly analyzing the cost data and discussing the merits with the Public Works Officer, it was determined that the following cost pools would sufficiently allow proper allocation of overhead costs. Listed in order of allocation, these pools are:

- Training costs
- Office supplies.
 - Automated Data Processing equipment (ADP), computers
 - Vehicles
 - General and Administrative (G&A)
 - Facilities Support Contracts (FSC)
 - Planning and Estimating, Engineering (PEE)
 - Shops Labor (Shops)
 - Shops Materials (materials)
 - Housing Management (HSG)
 - Construction & A/E contracts (ROICC)

The last six pools, (FSC, PEE, Shops, Materials, HSG, and ROICC) are the pools which have reimbursable cost drivers. The first five pools will be allocated to the last six pools.

In addition, there is one cost pool which includes some miscellaneous cost elements that will not be allocated. This pool includes reimbursable items for which PWO is unable to collect overhead costs due to contractual and legal agreements. It also includes some service items for which PWO does not receive any reimbursement, and which are not allocable to other cost pools.

1. Training, Office Supplies, and ADP equipment

These costs are often thought of as G&A costs, however, they have been broken out separately into their own categories because it was determined that different cost drivers from the one used for G&A would give a more reasonable allocation of these costs. Training includes all costs necessary to train the PWO employees. Office supplies consist of all of the pens, papers, copying machine costs, etc., that are necessary to perform the administration of the various branches of the PWO organization. ADP is the computers and printers and other associated costs used by the PWO staff.

2. Vehicles

A brief look at Figure 2 shows that vehicles is organizationally considered as a branch of the shops. The current practice is that automobiles are assigned to various customers, and all maintenance and fuel costs are included as part of the costs to the shops. The individual costs of an automobile is not tracked or charged to any customer.

Since many of these vehicles are assigned and operated by other PWO costs pools, it is necessary to allocate costs to those pools in order to properly account for the actual costs of operating those pools.

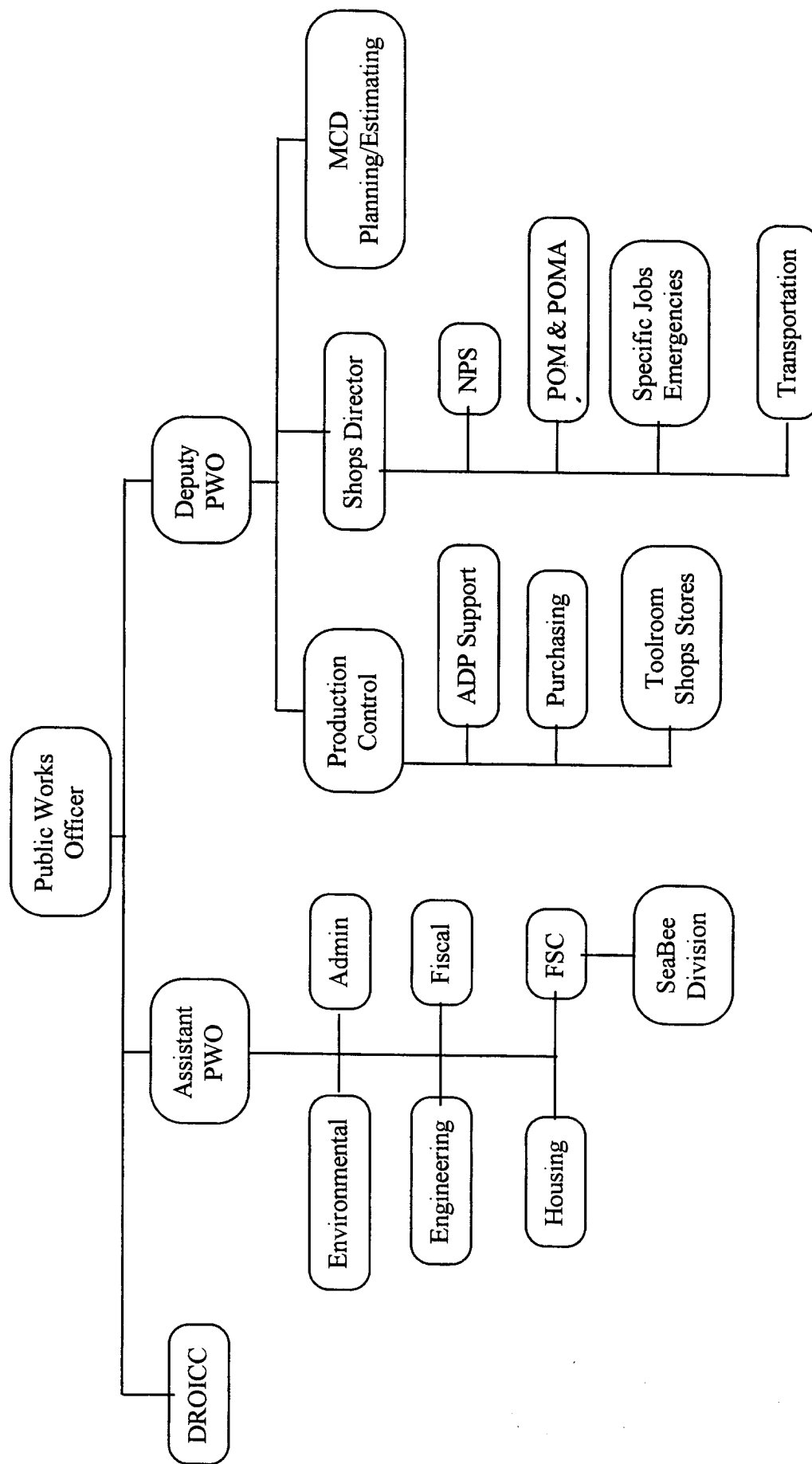


Figure 2 - Public Works Organization

It should be noted that there are currently 84 vehicles that are leased through General Services Administration (GSA) by the Army. The maintenance and fuel for these vehicles is also supplied by GSA contract and are not part of the costs used in the analysis in this thesis. While there is some administrative overhead costs associated with keeping track of who has which GSA vehicles, this thesis will not address this issue either as it is assumed to be insignificant.

3. General and Administrative Overhead

This pool usually includes costs for which it is most difficult to trace to any particular cost objective. G&A costs are typically the furthest overhead costs from the direct costs, both in terms of physical location and in organizational structure. Items typically included in this pool are the labor costs of the top echelon of management and administrative personnel, the costs of office supplies and other such costs that are difficult to assign to any more direct cost pool.

4. Facilities Support Contracts

The Facilities Support Contracts division performs the contracting actions necessary to provide facility service contracts such as janitorial services, grounds maintenance, pest control, and refuse collection. This division writes, advertises, awards and administers all Public Works service contracts with some help from engineering and ROICC.

5. Planning & Estimating, Engineering

The planning and estimating services performed by PWO is done by cooperation of a couple of groups. The Maintenance Control Division (MCD) prepares work orders for

station maintenance, repair and small construction or alteration type projects. The primary planning and estimating is done by MCD personnel, however, they may receive help from the Engineering division, or sometimes from a Naval Facilities Engineering Command (NavFac) division office. MCD also coordinates, schedules, and prioritizes work orders for Shop personnel. Additionally, MCD coordinates the Annual Inspection Summary which identifies the condition of all facilities and grounds for reporting requirements to the Major Claimant as well as for generating a maintenance backlog list.

The Engineering division provides design and engineering support for the installation. Specifically, it performs special project design and review, prepares military construction (MILCON) requests and justifications, prepares contract specifications, maintains facility plans and drawings, and performs long range planning. It is also responsible for providing professional input and advise to support maintenance, repair and construction projects.

These two divisions were grouped together because of the similarities in the design and planning type of work performed, and because there is significant overlap between them on many day to day tasks. In addition, the overhead costs associated with these two divisions are similar, being engineering technicians and use of computer aided design software which are frequently used interchangeably by either division.

6. Shops

This division includes a combination of maintenance and utility personnel who operate and perform routine maintenance and repairs for all facilities and utility systems. The cost elements included in this pool are predominantly labor. The current system of

charging a reimbursable customer for shops labor is on a labor hour basis, at a rate that is estimated to cover both direct labor and Shops overhead.

Shop material includes any types of supplies and materials used by the Shops personnel in the performance of their duties, to exclude automotive vehicles. Examples would be tools, lumber, asphalt, janitorial supplies, etc.

Typically, shop materials would not constitute a separate pool, but would be a direct cost in the overall shops category and would share a load of the shops overhead burden. However, in this case, it was found that some overhead costs were more directly related to the purchase of materials; while other overhead costs were closer related to the administration of the shops labor. Therefore, the operation of the shops overhead costs were broken down into a labor pool and a material pool. This means that if a customer's work order is heavy on materials and light on labor, they will pay a higher portion of the material overhead and less of the labor overhead, as it should be.

7. Housing Management

Organizationally, housing management is a branch of the PWO, but financially it operates separately and is in effect a reimbursable customer. HSG has its own budget and typically pays for all services received on a cost reimbursable basis. However, because the Public Works Officer serves as the Housing Officer, and is responsible for the administration of housing, this thesis will include an analysis of the housing administration costs.

Housing management includes the costs to administer and operate the housing units. This thesis will determine a unit rate per house to administer housing. Operational

costs such as house repairs and maintenance will not be included, as these costs are strictly performed on a cost reimbursable basis. However, the administration costs are effectively an overhead type cost, they do not increase when a single housing unit is added.

The question arises whether costs in other pools that are paid for entirely by HSG should be excluded from the cost analysis. In particular, shops labor includes two branches whose laborers salaries are paid for by housing, for La Mesa Village, POM and POMA. These costs have been left in the shops pool to analyze the actual allocation of shops overhead costs to direct labor. To remove these costs from the pool would not accurately reflect the distribution of shops overhead efforts.

8. ROICC

The planning and design of construction contracts is handled in different ways depending on size, complexity, and office workload. Large military construction (MILCON) projects are typically designed by NavFac contracting with architect/engineering (A/E) firms. When PWO does not have the in-house expertise they can refer complex designs to NavFac, or if PWO has too many projects and needs additional help they can access NavFac. When this is necessary, the work is "contracted" to a NavFac division at a rate of 2% of the estimated cost of construction, and thus it becomes a direct cost to PWO.

All contract administration, once the contract is awarded for construction, is performed by the Resident Officer in Charge of Construction (ROICC), which is currently headed by the Public Works Officer under another hat. The ROICC is a branch office of a NavFac division, and NavFac charges a set rate for these services. As of the time of this

thesis, NavFac charges 8% above the cost of the contract for administration of construction contracts, and 4% on FSC contracts that they administer. These rates are beyond the scope of this thesis, but will be included in the overall analysis for planning purposes.

There is some G&A costs incurred by the PWO in preparing and handling design and construction contracts that go to the ROICC. Therefore, it is appropriate to calculate the G&A overhead rate for ROICC contracts, as this cost should be borne by reimbursable customers who require construction and design from NavFac through PWO.

It is noteworthy that as a military officer, the Public Works officer's salary has not been included in any of the following calculations, as it is not within the PWO budget. In the future, if PWO begins to use Defense Business Operating Fund procedures and thus has to account for the costs of the military personnel, care should be taken to recognize the dual hat function and to ensure that both PWO and ROICC are not accounting for the full salary of the Public Works officer.

9. Miscellaneous Direct Reimbursables

There are a few areas within the workload for which PWO is not able to recoup overhead costs. The primary example is utilities, which by agreement in the ISSA with the customers, it is stated that utilities will be reimbursed at direct cost only. While there actually is some PWO fiscal branch overhead costs associated with allocation of the utility bills, since not all customers are individually metered, this cost will not be recovered by the utility invoice procedures.

However, it is not fair to other customers to pay for a share of G&A that should have been allocated to utility customers, just because of an agreement. Therefore, G&A will also be allocated to utilities, but recognized that this is a cost that NPS will have to bear until such agreements are changed.

Another cost that will be fit into this category is the cost of vehicles assigned to entities other than one of the PWO cost pools. The fire department and police department, for example, have several vehicles which consume part of the operating costs of the vehicle department. However, PWO is not currently reimbursed for these costs by those departments, it is simply part of the NPS workload and responsibility. These costs will be treated as direct costs and will not have overhead rates calculated for them. They will only be listed to complete the PWO workload amount.

C. COST ELEMENTS

This section will identify all of the individual cost elements and group them into their appropriate pools.

1. Labor Costs

Labor is the largest direct cost required to execute the PWO workload. The Public Works Officer manages the execution of this labor, but since all salaries are paid by the comptroller of NPS and do not comprise part of the PWO budget, labor is currently treated as a fixed cost. When workload exceeds labor available, the effect is an increase in the backlog of work, not an increase in the number of employees.

Each employee's salary and the associated fringe benefits has been identified and placed into a pool as shown in Appendix A. Each employee was placed into the pool that

most closely corresponded to the type of work they performed, **NOT** according to how their salary was funded. Some billets are funded by Army Family Housing, but the personnel may be working in the fiscal branch and was thus considered to be in the G&A overhead pool. The current distribution of laborers as shown in Appendix A, may change according to PWO priorities and should be revised as applicable.

Determining when a specific employee should be in the direct cost pool, as opposed to the overhead pool, is based on whether their time is kept track of by assigning it to a specific job. If a labor position is used as the basis for billing a customer, then it is a direct labor cost. All other laborers fall into various overhead pools. Using this description, most of the billets shown can be easily classified by their title description and placed into the appropriate pool based on the organization chart.

There are several billets that are currently vacant within the PWO organization, some of which are new anticipated billets. The costs of these billets has been estimated and included in the labor costs pools.

All labor cost figures shown were current as of October 1995, and do not typically change with fiscal years, but usually on the calendar year. Therefore, it is consistent to consider the labor figures as either FY95 or FY96 for comparison purposes.

2. Training and Office Supplies

The cost figures used in these two pools are based on the estimated FY96 budget figures of the same name, there is no further breakdown available. NPS and the Army ISSA each have figures budgeted for both training and office supplies.

3. ADP equipment

The production controller provided the estimated budget figures for FY96 expenditures on ADP equipment, to include hardware and software. In addition, the three support billets are included as overhead costs in this pool, and thus will receive an allocation of training and office supplies. The production controller's salary is not included in this pool, as the work he does is more general than just ADP related, thus he is included in the G&A labor pool.

4. Vehicles

This overhead pool consists of all fuel, parts, maintenance laborers, and administrative labor costs necessary to keep the vehicles running. The vehicle pool will also include allocated costs from the ADP, office supplies, and training pools. Fuel and parts costs are based on the amounts expended in FY95, while labor consists of the transportation branch of the PWO organization chart, Figure 2, minus the gardeners who are included in direct shops labor. All of these costs are considered part of the vehicle overhead pool, and will be allocated to the other cost pools, as it is not currently economically feasible to try and track the vehicle costs as a direct cost.

5. G&A

The labor portion of this pool predominantly includes personnel who work at the Public Works office located in Hermann Hall. They perform the general clerical and administrative duties, fiscal functions for all of PWO, and include the top level of managers within the PWO organization. The environmental branch labor is also included in this pool, as the services they currently perform benefit all other PWO divisions and

NPS as a whole. Using the organization chart, Figure 2, G&A is comprised of Fiscal, Admin, Environmental, the Deputy Public Works Officer, and the Production Controller, and ADP Support personnel.

The G&A pool will also include FY96 budgeted minor property costs, which are not economically feasible to trace to individual cost drivers. Minor property consists of things such as office furniture, filing cabinets, etc. but does not include computer equipment. Many of the other branches have some minor property (HSG is not included in these costs), but a very large portion is specifically used by the G&A functions. The other branches share of minor property costs would be overshadowed by their allotted share of the G&A costs, thus they are not specifically broken out.

G&A will also include allocations from the vehicle pool, and the training, ADP, and office supplies pools.

6. FSC

This overhead pool is comprised of the labor necessary to administer the FSC contracts, the contracts themselves, and the allocation of G&A, vehicles, training, ADP, and office supplies. The personnel involved include FSC managers, inspectors, and contracts personnel, all listed under the FSC section of the organization chart. Note that the costs of military personnel, one officer and twelve Seabees as indicated in Figure 2, are not included in the overhead costs.

The FSC branch also keeps track of the amount of dollars spent on their contracts. FSC contracts typically have a minimum and a maximum amount, and the total spent is somewhere in between. The actual costs expended in FY95 will be used for prorating

G&A overhead, while the maximum contract amounts will be used to distribute FSC overhead to individual contracts.

7. PEE

This pool includes labor costs comprised of the billets shown in the Engineering section and the MCD section of the organization chart. The pool also includes allocations of G&A, training, ADP, and office supplies. PEE does not have any assigned vehicles, but typically uses G&A assigned vehicles. This concern should be revised if future vehicle assignments include PEE.

8. Shops Overhead

The overhead labor in this category is comprised of the shops director and assistant, the maintenance supervisors (Level I and II), the administration assistant and transportation specialist, the emergency services dispatcher, and the tool room personnel. Other costs include allocations from G&A, office supplies, ADP, training, and assigned vehicles.

All other laborers in the shops are in the direct labor cost pool, which is broken out separately because it is basis for reimbursable costs in this pool.

9. Material

The primary function of the personnel in the Purchasing section of the Production Control branch is to procure material. This labor is thus included in the material overhead pool. Also in the pool are the allocations of vehicles, office supplies, training, ADP, and G&A. The direct costs of materials purchased in FY95 are included in this pool, and

listed separately as the basis for cost reimbursement. This includes materials for NPS, POM and POMA (from the ISSA), and all housing.

10. HSG

Only the administration billets that oversee the management of housing units are included as labor in this pool, and accounts for the Housing section listed on Figure 2. This labor pool is comprised of the personnel who work out of the housing office in La Mesa village. The HSG pool also includes allotments for G&A and assigned vehicles. This pool does not include maintenance personnel at the shops.

Since housing has its own budget for office supplies, minor property, training, and ADP, those costs are included directly into the HSG pool, and it does not share in those PWO pools. The figures used in this pool are based on actual NPS expenditures for FY95, and include the Army's projected share as itemized in the ISSA.

11. ROICC

The only costs included in this pool are the actual contract amounts awarded in FY95, both construction and A/E. These FY95 actual costs are used as the basis for allocating G&A to the ROICC pool. The ROICC office receives training, ADP support, vehicles, and office supplies within its NavFac budget.

III. ANALYSIS OF COSTS

A. INTRODUCTION

This section of the thesis will discuss the methods of allocating the costs to various pools, identify the necessary cost drivers for allocation, and identify the cost elements that will be used as the basis for billing the customer. This then determines the types of calculations that will be made to develop the overhead rates.

Many of the decisions made in this chapter are inherently related to the actual cost data presented at the end of this chapter. The reader may find it beneficial to refer to this data concurrently while trying to understand the analysis in this chapter. Allocation methods and cost drivers are actually functions of the cost data, meaning that different cost data might result in different cost drivers or allocation process.

B. ALLOCATION METHODS

This section will discuss the methods of allocating overhead and explain why they were considered to be the best methods. The results of an allocation should be to distribute the overhead costs as accurately as possible, so as to reflect the actual expenditure of those allocated costs, in spite of mandated restrictions.

The step-down allocation method is the primary one used here, which allows for partial recognition of services rendered by support departments to other support departments. This method most accurately reflects the physical processes involved, is easy to keep track of, and is less complex than other methods in light of the cost drivers being used. As indicated earlier, the steps for allocation are as follows:

- The training and office support pools will be allocated first to all other pools.
- Then the ADP pool will be allocated to the remaining pools.
- The assigned vehicles will then have their costs allocated to the remaining pools.
- G&A is the next pool to be allocated to the remaining pools.
- The remaining pools will allocate their overhead costs, including any previous allocations, to their reimbursable cost element.

The order of allocation is actually developed from the bottom up. The cost pools at the bottom are the pools that perform services that have a cost driver or element that may be used to bill a customer for those services. These bottom pools receive allocation of all upper pools, and their sum total should equate to the PWO workload.

Determining the order of the upper pools can become complex in trying to assure that costs are not double counted when they get to the bottom pool. Beyond that concern, the logic is based on being as simple as possible, and determining which pools are to be allocated to lower echelon pools.

Originally, training costs and all office supply costs were intended to be included as G&A, however, it was discovered that the cost drivers were not the same. Therefore these two pools were separated and are allocated to all of the lower pools. These top cost pools do not physically receive any support from the lower costs pools.

Because ADP has employees as costs, and they are the basis for allocation of training and office supplies, ADP is below those top two pools. The vehicle pool includes allocation of ADP, training and office supplies costs, but allocates its costs to the G&A

pool. (If the laborers in the ADP pool were assigned vehicles, the allocation process would have to have been different, to prevent double counting.)

In this case, vehicles had to be placed above G&A in order to account for the vehicles assigned to G&A. This also meant that G&A is not assigned to the vehicle pool, however, all G&A costs are accounted for in the bottom pools.

C. COST DRIVERS

Inherent to the process of establishing cost pools is the determination of relevant cost drivers. An overhead pool is of very little value if an effective cost driver cannot be identified that will demonstrate proper allocation of the overhead costs. The cost driver may or may not serve as the reimbursable cost element that PWO can bill the reimbursable customer for as a direct cost and then tack on the overhead charges.

The purpose of this section will be to define the cost drivers that will be used as the basis for allocating upper pool costs to the lower pools. As previously noted, a cost pool may have more than one cost driver. Justification for the chosen cost driver will be given, although it may be the case that another cost driver may have been just as fair and accurate.

1. Training

Training is directly related to laborers. The more laborers in a branch the more training dollars that are likely to be spent by that branch. Therefore the cost driver used to allocate the training pool is the number of personnel in a cost pool. Using the number of personnel is more accurate than using labor costs, as the more expensive laborers should not receive a disproportionate share of training. This cost driver is also in line with the

method used to determine the amount of training dollars received from the Army in the ISSA.

2. Office Supplies

Office supplies could have many cost drivers, such as labor costs, number of personnel, square footage of office space, or number of requests processed. In this case, it was decided that the driver that most accurately reflects the actual use of office supplies is the number of white collar type workers. An argument may be made that square footage is as accurate, but it is very difficult to measure and changes frequently.

Using this cost driver means that only the shops overhead personnel are used in the allocation process to the shops pool. This assumes that the blue collar workers (shops laborers) are using an insignificant amount of office supplies since they perform minimal administrative work.

3. ADP

The basis used to allocate the costs associated with ADP is the number of desk top computers. The costs spent on hardware and software are fairly evenly distributed to each person with a computer. It is assumed that the personnel costs included in this pool also spend a share of their time working on projects that equally benefit every person with a computer.

4. Vehicles

The vehicles assigned to each cost pool is kept track of and is easy to use as a cost driver. However, it is apparent that not all vehicles require the same costs in terms of annual fuel and maintenance. Therefore, to regard a sedan the same as a pickup the same

as a bus would not give proper results. The predominant vehicles that are assigned to other cost pools are sedans, pickups, and vans which will be the cost drivers for this pool.

In the calculations of Chapter IV, a method for allocating costs to each of the lower pools will be developed. The vehicle branch of PWO has records of the fuel and maintenance costs for FY95 grouped by various types of vehicles. Note that a van is considered to be the same as a heavy truck, which is distinguished from a pickup.

Currently, NavFac is working on a computerized procedure that could more accurately trace the actual vehicle costs of each vehicle.

5. G&A

It is also difficult to determine appropriate cost drivers for this pool, as the direct costs feeding into it are very diverse; labor hours, percentages, contract amounts, vehicles. Typical business practice is to charge G&A as a percent of all subordinate cost pools, unless there are more obvious cost drivers.

While the lions share of the G&A costs are labor costs (73%), and a significant portion of all costs are labor related (44%), it would not be equitable to allocate G&A based on direct labor hours. Since another significant direct cost is housing which uses the number of houses as a cost driver, to use labor as the G&A cost driver would mean very little allocation of G&A costs to housing, which does not reflect reality. Similarly, FSC requires a great deal of G&A efforts, but labor costs is a relatively small portion of the FSC cost pool.

The fairest way is to allocate G&A using the subtotal of the lower cost pools as the cost driver. This subtotal includes all direct and overhead costs in the pool, plus the

allocations of the previously assigned pool. Once this distribution of G&A was calculated, the results were compared on an intuitive basis by the Public Works Officer, who agreed that it appeared equitable.

D. REIMBURSABLE COST ELEMENTS

The cost pools at the bottom step of the allocation process have received a share of the burden of all the upper pools, and will not share their cost to any other pool. Instead, these pools must establish cost driver that will be used as the basis for billing a reimbursable customer. This cost driver should also accurately distribute overhead costs to the customer, based on the amount of overhead services received.

1. FSC

There is a very obvious distinction between overhead costs and direct costs associated with FSC and thus the cost driver seems apparent. The direct cost is the contract award amount and all other associated costs are overhead. In addition, NavFac tacks on an overhead charge of 4% for FSC and the basis they use is the contract award amount.

However, the actual overhead costs expended are not necessarily a reflection of the size of the contract. A small \$20,000 contract may be just as expensive to award and administer as a \$10,000,000 contract, or it may be significantly more or less. Thus the relationship between the direct costs and the overhead costs is not linear nor is it obvious.

There are three candidates for cost drivers for FSC overhead: individual contracts, the value of the contracts, or a hybrid combination of each. If each individual contract were to pay an equal share of the total FSC overhead costs, a small contract would pay

the same amount of overhead as a large contract. For example, the \$2,000 contract for Fleet Numeric and Oceanographic Center (FNOC) would pay over \$30,000 for FSC overhead, an amount that would be unacceptable to the customer. However, this method most accurately reflects reality; most contracts take a near equal amount of FSC administrative attention.

Conversely, using the value of the contract as the basis for overhead distribution might mean that a large contract would pay for a significantly larger share of the FSC overhead. Yet in actuality, a large contract does not take significantly more effort to award and administer than a smaller valued contract. The Job Order Contract would pay almost half of the FSC overhead, while only being one of twenty-four contracts.

In the interest of balancing fairness and accuracy, considering contract size, a hybrid method will be developed in this thesis. A hybrid of the two methods would mean that smaller contracts will not pay their full share of the overhead burden, but will pay a higher percentage of their contract cost. A larger contract would pay a lower percentage of contract cost for overhead, but may pay more than their share of the total FSC overhead costs. The hybrid method is developed based on experience and judgment, so as to allow PWO to recoup all of its FSC overhead costs.

A flat percentage rate is set for the first few dollars of contract amount awarded, and will be slightly higher than the prorated percentage rate. The percentage rates developed will decrease at specified contract amounts, inversely similar to the graduated income tax rate. This means that the large contracts pay less than the prorated percentage, but more than the equal overhead distribution method.

FSC contracts typically include indefinite quantity contracts that have a minimum and a maximum amount. The actual amount expended on an FSC contract must be between these two limits, but it is never known until the end of the fiscal year. To avoid the problem of the unknown, and because the minimum amount is typically arbitrarily low, this thesis will use the maximum contract amount as the allocation basis for FSC overhead.

2. PEE

The billing unit for PEE is the labor hour, thus it also will serve as the cost driver. It is possible to calculate the anticipated available labor hours based on the laborers in the direct cost portion of this pool, assuming 2000 annual labor hours per person. The direct labor costs, overhead labor costs, and other overhead costs in the PEE pool (including G&A and assigned vehicles) can then be divided by the total available hours to determine an hourly rate that includes all costs.

This rate should be rounded off for billing purposes. Rounding up or down depends on the confidence level of how many labor hours will actually be expended. The actual labor hours will vary, based on employees leaving or being hired, and based on whether there is enough work to keep them busy.

3. Shops

Similarly to PEE, the billing unit for shop labor is the labor hour, and it will be used as the cost driver for allocation overhead. The difference is that direct labor rates typically vary depending on the category, i.e., carpenter, electrician, plumber, etc. Therefore, instead of an hourly rate being calculated that includes all overhead costs, overhead will be allocated on a percentage of direct labor costs.

To calculate this, all overhead costs in the shops pool will be divided by the total direct labor costs to determine a percentage. This percentage rate will account for all overhead associated with shops labor.

4. Materials

Determining a materials cost driver is difficult because there are two candidates, but neither is readily known in advance. Each requisition could be a cost driver and thus would include the same amount for materials overhead cost on each one. This would be similar to the individual contract method discussed for FSC and has similar drawbacks. The other method is to allot overhead based on the value of the purchase requisition, similar to the contract value method discussed in FSC.

During the budget planning phase, the PWO does estimate the total dollars that will be spent on shops materials. There is no estimate made as to the number of requisitions that will be made. Therefore, using the estimated dollars to be spent as the base, the overhead rate will be determined. Each requisition will then have a direct materials cost and a percentage will be tacked on to cover materials overhead costs.

5. ROICC

NavFac already charges a percentage rate for all contracts that go the ROICC to be administered, and it is based on the estimated costs of construction related to that contract. For simplicity sake, it is deemed most appropriate to also use the estimated cost of construction as the cost driver to allocate the PWO overhead associated with developing construction contracts. Using FY95 data, an overhead rate can be calculated by dividing the G&A costs allocated to the ROICC by the total contracts awarded.

6. HSG

Several cost drivers were discussed with the housing administration and the Public Works Officer, but it was determined that the simplest one is the number of housing units. This basis is easier for billing reimbursable customers, and is fair as each house typically requires the same amount of effort to administer as any other unit.

The unit rate per house will be calculated by dividing the total costs in the HSG pool, including previously allocated costs, by the total number of housing units that housing is responsible for. Again, it is noted that this unit rate is strictly for the administrative costs associated with each housing unit, and does not include the operational costs.

E. DATA PRESENTATION

The following table presents the data collected for the PWO workload in terms of general cost elements. This is the raw data, grouped into the various cost pools and cost elements described in this chapter. The figures used in Table 3.1 do not include any allocations of costs, as these will be discussed in detail in Chapter IV.

For analysis, it is also necessary to breakout labor costs and personnel distribution by cost pool. The summary data is shown in Table 3.2, while the backup data is listed in Appendix A. Note that the Personnel column does include military labor while the Labor Cost column does not.

<u>Cost Pools</u>	<u>Cost Elements</u>	<u>Element Value</u>	<u>Total Pool Value</u>
Training Costs			\$ 123,250
	NPS, PWO budget	\$ 99,000	
	Army ISSA	\$ 24,250	
Office Supplies			\$ 101,600
	NPS, PWO budget	\$ 24,000	
	Army ISSA	\$ 77,600	
ADP			\$ 342,656
	Admin Labor	\$ 132,656	
	PWO Budgeted	\$ 117,000	
	Reimbursable Budgeted	\$ 93,000	
Vehicles			\$ 918,454
	Labor Costs	\$ 692,139	
	Fuel & Parts	\$ 226,315	
G&A			\$ 785,948
	Admin Labor	\$ 643,948	
	Minor Property	\$ 142,000	
FSC			\$ 7,798,782
	Admin Labor	\$ 684,636	
	Contracts	\$ 7,114,146	
ROICC			\$ 931,559
	Construction Contracts	\$ 875,559	
	Design Contracts	\$ 56,000	
PEE			\$1,470,723
	Supervisory Labor	\$ 465,946	
	Direct Labor	\$ 1,004,777	
Shops			\$ 9,837,409
	Admin/Supervisory Labor	\$ 1,300,726	
	Direct Labor	\$ 8,536,682	
Materials			\$ 3,205,095
	Labor	\$ 426,386	
	Materials Purchased	\$ 2,778,709	
HSG			\$1,118,050
	Admin Labor	\$ 849,150	
	Office Supplies & Training	\$ 176,800	
	Army ISSA	\$ 92,100	
Others			\$ 4,645,197
	Utilities	\$ 4,645,197	
Total			\$31,278,723

Table 3.1
Summary of PWO Workload Costs

<u>Cost Pools</u>	<u>Personnel in Pool</u>	<u>Labor Costs (inc. fringes)</u>
FSC	17	\$ 684,636
G&A	17	\$ 643,948
Shops Overhead	24	\$ 1,300,726
Shops Directs	201	\$ 8,536,682
Materials	11	\$ 426,386
HSG	22	\$ 849,150
PEE	26	\$ 1,470,723
Vehicles	17	\$ 692,139
ADP	3	\$ 132,656
Total	338	\$ 14,737,047

Table 3.2
Summary Breakdown of PWO Labor Costs and Personnel

IV. DETERMINATION OF OVERHEAD RATES

A. INTRODUCTION

This chapter will discuss the allocation of costs to the lowest pools and the calculation of the overhead rates for those cost pools. All of the costs have been identified, grouped into various pools, and defined as overhead or direct costs. Allocation procedures and associated cost drivers have been chosen, and will now be used to derive the results.

This chapter will use a narrative format to describe the actual calculations. If necessary, problems or assumptions made will be discussed as encountered.

B. ALLOCATIONS

1. Training & Office Supplies

The allocation of the training pool and the office supplies pool are both based on the percentage of laborers in the pools to receive allocation. This percentage is determined by dividing the number of laborers in a specific pool by the total number of laborers being considered. Multiplying this percentage by the total value of the training or office supplies pool determines the allocation of dollars to the specific pool.

Using the FSC allocation of training pool costs as an example, there are seventeen laborers in the FSC pool, divided by the three hundred sixteen total laborers to whom training costs are being allocated, gives a percentage of 5.38. Multiplying this times the total training pool costs of \$123,250 (from Table 3.1) results in \$6,631 being allocated to the FSC cost pool.

This same calculation is performed for each cost pool receiving allocation from the training and office supply pools. Tables 4.1 and 4.2 show the calculated allocations for the training pool and the office supplies pool, respectively.

<u>Cost Pools</u>	<u>Personnel in Pool</u>	<u>Percent of Total</u>	<u>Allocation of Training Costs</u>
FSC	17	5.38 %	\$ 6,631
G&A	17	5.38 %	\$ 6,631
Shops OH & Direct	225	71.20 %	\$ 87,757
Materials	11	3.48 %	\$ 4,290
PEE	26	8.23 %	\$ 10,141
Vehicles	17	5.38 %	\$ 6,631
ADP	3	0.95 %	\$ 1,170
Total	316	100.00 %	\$ 123,250

Table 4.1
Training Pool Allocation

<u>Cost Pools</u>	<u>Personnel in Pool</u>	<u>Percent of Total</u>	<u>Allocation of Office Supplies Costs</u>
FSC	17	14.78 %	\$ 15,019
G&A	17	14.78 %	\$ 15,019
Shops OH	17	14.78 %	\$ 15,019
Materials	24	20.87 %	\$ 21,203
PEE	11	9.57 %	\$ 9,718
Vehicles	26	22.61 %	\$ 22,970
ADP	3	2.61 %	\$ 2,650
Total	115	100.00 %	\$ 101,600

Table 4.2
Office Supplies Pool Allocation

2. ADP Equipment

Table 4.3 presents the results of including the training and office supplies costs allocated to the ADP pool.

<u>Pool Component</u>	<u>Value</u>
Labor	\$ 132,656
PWO Budgeted	\$ 117,000
Reimbursable Budgeted	\$ 93,000
Allocated training	\$ 1,170
Allocated office supplies	\$ 2,650
Total	\$ 346,476

Table 4.3
Allocated ADP Pool

Table 4.4 then shows the allocation of the ADP pool costs to lower level cost pools, on the basis of assigned computers. For example, dividing the number of computers assigned to personnel in the shops by the total number of computers results in a percentage of 29.6. Multiplying this by the total cost of the ADP pool (\$346,476) allocates \$102,436 to the shops overhead pool.

Housing computers are included in the calculation of ADP allocation because the ADP support branch of PWO serves housing on a non-reimbursable basis.

<u>Cost Pools</u>	<u>Computers Assigned</u>	<u>Percent of Total</u>	<u>Allocation of ADP Costs</u>
FSC	15	13.0 %	\$ 45,193
G&A	15	13.0 %	\$ 45,193
PEE	22	19.1 %	\$ 66,282
Shops	34	29.6 %	\$ 102,436
Materials	9	7.8 %	\$ 27,116
Vehicles	2	1.7 %	\$ 6,026
HSG	18	15.7 %	\$ 54,231
Total	115	100.0 %	\$ 346,476

Table 4.4
ADP Pool Allocation

3. Vehicles

The total cost of the vehicle pool including allocations from prior pools is shown in Table 4.5. The process for determining a vehicle rate is simply dividing the total vehicle pool costs by the number of vehicles. However, as mentioned previously, different vehicles may require different levels of maintenance and attention. Therefore, it is necessary to determine a method of comparing the different types of vehicles.

<u>Pool Component</u>	<u>Value</u>
Labor	\$ 692,139
Fuel & Parts	\$ 226,315
Allocated training	\$ 6,631
Allocated office supplies	\$ 6,026
Allocated ADP	\$ 15,019
Total	\$ 946,129

Table 4.5
Allocated Vehicle Pool

A quick analysis of the actual amounts spent in FY95 is shown in Table 4.6. Contrary to intuition, the average cost per sedan was greater than the average costs for the other vehicles. Further research suggested correlation between the total mileage of each vehicle type and the costs per vehicle. Using the pickup as the standard vehicle type, since it had the lowest cost per vehicle, the other vehicle types are assigned a relative weighting which will allow them to be compared. The weighting of 2.67 for sedans is the result of dividing the average cost per sedan (\$1,650) by the average cost per pickup (\$618).

<u>Type of Vehicle</u>	<u># of vehicles in Pool</u>	<u>Total \$ Spent on Type of Vehicle</u>	<u>Average Costs per Vehicle</u>	<u>Relative Weighting</u>
Sedans	17	\$ 28,053	\$ 1,650	2.67
Pickups	35	\$ 21,616	\$ 618	1.0
Heavy Trucks	64	\$ 62,335	\$ 974	1.58
Other Vehicles	144	\$ 100,479	\$ 698	1.13

Table 4.6
Distribution Of Fuel And Maintenance Costs

Table 4.7 lists the distribution of sedans, vans, pickups, heavy trucks and other vehicles assigned to each of the cost pools. Note that vehicles assigned to other entities at NPS are included in the distribution of costs. The weighted total column multiplies the number of each type of vehicle by the relative weighting figure derived in Table 4.6. (Note that vans are considered as heavy trucks for analysis purposes.) Thus, the weighted total of G&A pool is the sum of one van times 1.58 plus two sedans times 2.67 plus one

pickup times 1.0 for a total of 7.9. These weighted totals are summed up to give the weighted average number of vehicles (206.8) Dividing the total vehicle pool costs to be allocated (\$946,129 from Table 4.5) by the 206.8 figure results in a average vehicle cost of \$4,574. This average cost is then multiplied by the weighted total for each pool to allocate the vehicle pool costs to the remaining pools, and shown in the right most column of Table 4.7.

<u>Cost Pools</u>	<u>Vans</u>	<u>Sedans</u>	<u>Pickups</u>	<u>Heavy</u>	<u>Weighted Total</u>	<u>Times Vehicle Rate</u>
G&A	1	2	1	0	7.9	\$ 36,131
HSG	1	2	2	0	8.9	\$ 40,695
FSC	0	3	3	0	11.0	\$ 50,253
Shops	4	4	37	50	110.4	\$ 504,055
Others	4	9	10	25	68.6	\$ 312,928
Totals	10	20	53	75	206.8	\$ 946,129

Table 4.7
Vehicle Pool Allocation

4. G&A

Since the basis of distributing G&A is based on the total costs of the pools to which G&A costs are allocated, it is necessary to sum up each of the remaining pools with their respective allocations from the previous pools, to include both direct and indirect costs. Tables 4.8 through 4.14 show the results of the current costs to each pool as costs have been distributed up to this point, a suballocation.

<u>Pool Component</u>	<u>Value</u>
Labor	\$ 643,948
Minor Property	\$ 142,000
Allocated training	\$ 6,631
Allocated office supplies	\$ 15,019
Allocated ADP	\$ 45,193
Assigned Vehicles	\$ 36,210
Total	\$ 889,001

Table 4.8 - Allocated G&A Pool

<u>FSC Pool Components</u>	<u>Value</u>
Labor	\$ 684,686
Allocated training	\$ 6,631
Allocated office supplies	\$ 15,019
Allocated ADP	\$ 45,193
Assigned Vehicles	\$ 50,363
FSC Contracts	\$ 7,114,146
Total	\$ 7,915,988

Table 4.9 - Suballocated FSC Pool

<u>PEE Pool Components</u>	<u>Value</u>
Labor	\$ 1,470,723
Allocated training	\$ 10,141
Allocated office supplies	\$ 22,970
Allocated ADP	\$ 66,282
Assigned Vehicles	\$ 0
Total	\$ 1,570,117

Table 4.10 - Suballocated PEE Pool

<u>HSG Pool Components</u>	<u>Value</u>
Labor	\$ 849,150
Office Supplies/Training	\$ 176,800
Army ISSA	\$ 92,100
Allocated ADP	\$ 54,231
Assigned Vehicles	\$ 40,785
Total	\$ 1,213,066

Table 4.11 - Suballocated HSG Pool

<u>ROICC Pool Components</u>	<u>Value</u>
Construction Contracts	\$ 875,559
Design Contracts	\$ 56,000
Total	\$ 931,559

Table 4.12 - Suballocated ROICC Pool

<u>Shops Pool Components</u>	<u>Value</u>
Supervisory/Admin Labor	\$ 1,300,726
Allocated office supplies	\$ 21,203
Allocated training	\$ 87,757
Allocated ADP	\$ 102,436
Assigned Vehicles	\$ 505,158
Direct Labor	\$ 8,536,682
Total	\$ 10,553,964

Table 4.13 - Suballocated Shops Pool

<u>Materials Pool Components</u>	<u>Value</u>
Administrative Labor	\$ 426,386
Allocated office supplies	\$ 9,718
Allocated training	\$ 4,290
Allocated ADP	\$ 27,116
Assigned Vehicles	\$ 0
Cost of Materials	\$ 2,778,709
Total	\$ 3,246,219

Table 4.14 - Suballocated Materials Pool

To calculate a general G&A rate, the remaining pools subtotals are aggregated to determine the denominator, shown in the second column of Table 4.15. The numerator is the costs in the G&A pool, which includes the previously allocated costs shown in Table 4.8. Dividing the G&A costs (\$889,001) by the aggregated remaining pools (\$30,076,109) produces a rate of 2.96%. Multiplying this rate by the subtotal amount for each remaining cost pool, determines that cost pool's share of the G&A overhead costs, as shown in the third column of Table 4.15. Note that the other category in this analysis is comprised entirely of the utilities costs shown in Table 3.1.

The determination of the G&A rate is the only area where FY95 and FY96 numbers were combined in the calculations, which is the source of some error. However, it is recognized that a "rate" is only an approximation to begin with. The section in Chapter V that discusses sensitivity analysis shows that trying to extrapolate FY95 figures to FY96 estimates would not result in an appreciable difference. If more accurate records

are kept for FY96 and the data in this thesis is updated, a more accurate G&A rate can be determined.

<u>Pools</u>	<u>Value</u>	<u>G&A Allocation</u>
FSC	\$7,915,988	\$ 233,984
PEE	\$ 1,570,117	\$ 46,410
HSG	\$ 1,213,066	\$ 35,856
ROICC	\$ 931,559	\$ 27,535
Shops	\$ 10,553,964	\$ 311,958
Materials	\$ 3,246,219	\$ 95,953
Others	\$ 4,645,197	\$ 137,304
Total	\$ 30,076,109	\$ 889,001

Table 4.15 - Allocation of G&A pool

The total of the remaining overhead pools will be calculated and each pool's percentage share calculated. That share of the G&A costs, in dollar terms, will be added to the overhead costs of each of those pools.

C. OVERHEAD RATES

This section will present the calculated overhead rates for the cost pools that have reimbursable cost elements associated with them. These are the rates that the reimbursable customers will see.

1. FSC

The total direct costs and overhead costs allocable to FSC are shown in Table 4.16. Dividing the overhead total by the direct cost total indicates a general overhead rate of 14.56%.

<u>FSC Pool Costs</u>	<u>Value</u>
Labor	\$ 684,686
Allocated training	\$ 6,631
Allocated office supplies	\$ 15,019
Allocated ADP	\$ 45,193
Assigned Vehicles	\$ 50,363
Allocated G&A	\$ 233,984
Total Overheads	\$ 1,035,826
FSC Contracts	\$ 7,114,146
Percentage	14.56%

Table 4.16 - Allocated FSC Pool

Table 4.17 lists the FY95 facilities support contracts by increasing dollar amounts. This table also shows the overhead distributed using the three ways discussed in Chapter III. The third hybrid method was derived empirically, using various combinations of graduated rates to ensure that overhead costs were covered. There are infinite rate structures that could accomplish the same ends, the one used here is considered fair and was agreed upon by the Public Works Officer.

The graduated rate structure used has three separate rates. The overhead rate is 16% for the first \$100,000 of contract value. The rate drops to 10% for the next \$400,000 of contract value, 6% for the next \$1,500,000, and is 3% for remaining value of the contract. The fourth column of numbers in Table 4.17 shows the effective overhead rate for the FY95 contracts.

Contract Title	Contract Value	Equal Share per contract		Percentage of total contracts		Hybrid	
		Value	%	Value	%	Value	%
Interior Plant Maintenance, FNOC	\$ 2,100	\$ 43,159	2055.2 %	\$ 163	7.8 %	\$ 336	16.0 %
Chimney Cleaning	\$ 7,469	\$ 43,159	577.8 %	\$ 581	7.8 %	\$ 1,195	16.0 %
Lease Vehicles	\$ 15,600	\$ 43,159	276.7 %	\$ 1,213	7.8 %	\$ 2,496	16.0 %
Manhole Restoration, La Mesa	\$ 15,975	\$ 43,159	270.2 %	\$ 1,242	7.8 %	\$ 2,556	16.0 %
Install Carpet, Bldgs 232, 233, 234	\$ 16,755	\$ 43,159	257.6 %	\$ 1,303	7.8 %	\$ 2,681	16.0 %
Grounds Maintenance, Point Sur	\$ 19,992	\$ 43,159	215.9 %	\$ 1,555	7.8 %	\$ 3,199	16.0 %
Shelving	\$ 22,500	\$ 43,159	191.8 %	\$ 1,750	7.8 %	\$ 3,600	16.0 %
Test, Service, Inspect Fire Systems	\$ 22,902	\$ 43,159	188.5 %	\$ 1,781	7.8 %	\$ 3,664	16.0 %
Install Carpet, Bldg 330	\$ 24,895	\$ 43,159	173.4 %	\$ 1,936	7.8 %	\$ 3,983	16.0 %
Interim Grnds Maint., WWII Bldgs	\$ 63,372	\$ 43,159	68.1 %	\$ 4,929	7.8 %	\$ 10,140	16.0 %
Household Appliance Maintenance	\$ 104,090	\$ 43,159	41.5 %	\$ 8,096	7.8 %	\$ 16,450	15.8 %
Tree Trimming	\$ 119,960	\$ 43,159	36.0 %	\$ 9,330	7.8 %	\$ 18,196	15.2 %
Interior Painting, NPS	\$ 121,110	\$ 43,159	35.6 %	\$ 9,419	7.8 %	\$ 18,322	15.1 %
Interior Painting, HSG	\$ 163,674	\$ 43,159	26.4 %	\$ 12,730	7.8 %	\$ 23,004	14.1 %
Pest Control	\$ 201,092	\$ 43,159	21.5 %	\$ 15,640	7.8 %	\$ 27,120	13.5 %
Asphalt	\$ 231,453	\$ 43,159	18.6 %	\$ 18,001	7.8 %	\$ 30,460	13.2 %
Grounds Maintenance	\$ 451,166	\$ 43,159	9.6 %	\$ 35,089	7.8 %	\$ 54,628	12.1 %
Grounds Maintenance	\$ 464,307	\$ 43,159	9.3 %	\$ 36,111	7.8 %	\$ 56,074	12.1 %
Janitorial	\$ 675,725	\$ 43,159	6.4 %	\$ 52,554	7.8 %	\$ 70,543	10.4 %
Multi-Trade	\$ 717,723	\$ 43,159	6.0 %	\$ 55,821	7.8 %	\$ 73,063	10.2 %
Family Housing Maintenance	\$ 1,145,806	\$ 43,159	3.8 %	\$ 89,115	7.8 %	\$ 98,748	8.6 %
Install Carpet	\$ 1,312,879	\$ 43,159	3.3 %	\$ 102,109	7.8 %	\$ 108,773	8.3 %
Custodial	\$ 1,397,690	\$ 43,159	3.1 %	\$ 108,705	7.8 %	\$ 113,861	8.1 %
JOC	\$ 6,000,000	\$ 43,159	0.7 %	\$ 466,650	7.8 %	\$ 300,000	5.0 %
Totals	\$ 13,318,235	\$ 1,035,826		\$ 1,035,826		\$ 1,043,093	

Table 4.17

Various Methods of Allocating FSC Overhead Costs

Note that use of this method would allow PWO to recoup approximately \$7,000 in excess of the allocated overhead, a 0.7% increase. This amount is not considered significant, as the methods of estimating are not that precise.

One should also note that the overhead rate and charge is based on the maximum possible contract value. In addition, each contract is charged an overhead rate of 4% by NavFac for administration costs.

2. PEE

Table 4.18 shows the total costs to the PEE pool, including all direct and allocated overhead costs. The hourly labor rate for project estimating and engineering is calculated by dividing the total pool costs (\$1,616,527) by the total direct labor hours available (36,000). The available labors hours is determined by multiplying the number of direct laborers, eighteen per the figures shown in Appendix A, by 2000 work hours per year. The resulting hourly rate is \$44.90 per hour, which includes the direct labor and all associated overhead costs.

<u>PEE Pool Components</u>	<u>Value</u>
Labor	\$ 1,470,723
Allocated training	\$ 10,141
Allocated office supplies	\$ 22,970
Allocated ADP	\$ 66,282
Assigned Vehicles	\$ 0
Allocated G&A	\$ 46,410
Total	\$ 1,616,527
PEE Rate	\$ 44.90 / hr

Table 4.18 - Allocated PEE Pool

3. Shops Labor

The total overhead costs assigned to the shops labor pool are shown in Table 4.19, as well as the direct labor costs. Dividing the overhead total by the direct labor costs gives a markup rate of 27.3% on labor costs for shops overhead.

<u>Shops Pool Components</u>	<u>Value</u>
Supervisory/Admin Labor	\$ 1,300,726
Allocated office supplies	\$ 21,203
Allocated training	\$ 87,757
Allocated ADP	\$ 102,436
Assigned Vehicles	\$ 505,158
Allocated G&A	\$ 311,958
Total	\$ 2,329,239
Direct Labor	\$ 8,536,682
Markup Rate	27.3 %

Table 4.19 - Allocated Shops Pool

4. Materials

The total overhead costs assigned to the materials pool are shown in Table 4.20, and the costs of materials purchased. Dividing the overhead total by the materials purchased results in the markup rate of 20.3% for materials.

<u>Materials Pool Components</u>	<u>Value</u>
Administrative Labor	\$ 426,386
Allocated office supplies	\$ 9,718
Allocated training	\$ 4,290
Allocated ADP	\$ 27,116
Assigned Vehicles	\$ 0
Allocated G&A	\$ 95,953
Total	\$ 563,463
Cost of Materials	\$ 2,778,709
Markup Rate	20.3 %

Table 4.20 - Allocated Materials Pool

5. ROICC

The overhead rate for ROICC contracts is calculated by dividing the G&A costs allocated to the ROICC pool, \$27,535 from Table 4.15, by the total ROICC pool costs, \$931,559 shown in Table 4.12. The division produces a rate of 3.0%, which corresponds to the administrative efforts of PWO. This 3% is the overhead that should be tacked onto the estimated costs of construction.

The customer will also have to pay the NavFac overhead rates for design and construction contracts. Those rates can be added directly to determine the overhead amount the customer will pay in addition to the cost of the contract. Design contracts will be 3% for PWO plus 2% for NavFac for a total of 5%. Adding the PWO rate to the NavFac rate of 8% for construction contracts provides a rate of 11% for the customer.

6. Housing Administration

The housing office currently has 14 housing units at NPS, 877 at La Mesa Village, and 1,688 at the POMA. Table 4.21 shows the total administrative costs associated with managing these housing. Simply dividing this total (\$1,248,922) by the total number of houses being managed (2,579) gives a rate of \$484 per house.

<u>HSG Pool</u>	<u>Value</u>
Labor	\$ 849,150
Office Supplies/Training	\$ 176,800
Army ISSA	\$ 92,100
Allocated ADP	\$ 54,231
Assigned Vehicles	\$ 40,785
Allocated G&A	\$ 35,856
Total	\$ 1,248,922
Rate	\$484 / house

Table 4.21 - Allocated HSG Pool

D. UNRECOVERABLE OVERHEAD COSTS

There are a few costs that have been allocated that will not be recovered due to reasons discussed in Chapter III. The two costs that have been specifically identified are G&A on utilities costs and vehicle costs that are not reimbursed. \$137,304 of allocated G&A costs will not be recouped for the \$4,645,197 of utilities costs; if they were the rate would be 2.96%. The vehicles pool allocated \$312,938 to customers who are currently not reimbursing PWO for those costs.

V. SUMMARY AND RECOMMENDATIONS

A. INTRODUCTION

This thesis has examined the costs involved in operating the Public Works Office at NPS. Costs were categorized as either direct costs or overhead costs and grouped into cost pools. The overhead costs were then allocated to various cost drivers, and an overhead rate determined for each direct cost unit.

This final section will summarize the data and the calculations that have been made and make recommendations as to how these overhead rates can be used practically by the PWO.

B. SUMMARY

1. Overhead Rates

Table 5.1 lists the calculated overhead rates for the various reimbursable cost elements as determined by this thesis. The general and administrative overhead rate is the same as the figure shown for ROICC, 3.0%. These markups or costs can be applied to the direct cost drivers to determine the overhead costs that should be included in the reimbursable invoice to the customer.

Only the rates for items that can be charged overhead have been shown, which means utilities have not been included in this list. If the regulations or ISSAs change to allow the recovery of overhead costs for utility charges, the overhead rate for them should be 2.96%.

<u>Cost Pools</u>	<u>Overhead Rate</u>	<u>Cost Driver</u>
FSC		Markup per maximum value of contract
	16.0%	first \$100,000
	11.0%	next \$400,000
	6.0%	next \$1,500,000
	3.0%	remainder of costs
PEE	\$44.90	Cost per direct labor hour
Shops	27.3%	Markup per direct labor cost
Materials	20.3%	Markup per direct cost of materials
ROICC	3.0%	Markup per estimated cost of contract
HSG	\$484.27	Cost per housing unit

Table 5.1 - Summary of Overhead Rates

2. Error Analysis

The potential sources of error in arriving at the stated overhead rates should be identified. Some of these are the results of limited access to current figures or estimates used, while some are decisions based on circumstances that may change in the future.

The Public Works Office organizational structure is in a state of flux. A significant change was made during this thesis research, when the Production Control branch was taken out from under the Shops Director and made into an equal branch with the Shops Director. Additionally, personnel are frequently moved around between various parts of the organization, often on an extended temporary basis. These repositionings will slightly alter the overhead rate calculations.

The assignment of vehicles and computers to different personnel will also have an effect on the calculations. Any significant change to the data collected will change the results.

The rate calculations for FSC contracts have been arbitrarily set and may need to be redefined as the distribution of contract values changes. In addition, it may be determined that another method of allocating the overhead costs may be more appropriate.

There also may be better cost drivers that would more accurately distribute overhead costs.

3. Sensitivity analysis

One of the major assumptions made in calculating the overhead rates is the value of the cost drivers. Total overhead costs typically do not vary with changes in output, while direct costs correspond more directly to those changes. Therefore, if less contracts are awarded, fewer hours of labor are used, less labor or material costs are expended, or fewer houses are managed, then PWO will fail to recover sufficient overhead costs.

A sensitivity analysis demonstrates the effects of changes to the cost drivers and their results on the overhead recouped. This gives the Public Works Officer a feel for the variations that may be experienced by changes in the direct workload. This analysis will show how much each cost driver must change to effect the bottom line results by ten percent. Ten percent is chosen because PWO is already failing to recover over six percent of its overhead costs due to ISSAs and other agreements.

Appendix B shows the spreadsheet setup used to derive the calculations, which used the goal seeking function of the spreadsheet program to determine the upper and

lower bounds. Table 5.2 shows boundaries for varying each individual driver amount so as to cause a ten percent change to the recovered overhead costs. Table 5.3 shows the boundaries derived from varying the overhead rates.

<u>Cost Pool</u>	<u>Upper Bound</u>	<u>Lower Bound</u>
PEE	52,196 hrs	19,800 hrs
Shops	\$ 11,183,053	\$ 5,890,311
Materials	\$ 6,365,100	\$ 0
ROICC	\$ 25,535,188	\$ 0
HSG	4,081 houses	1,077 houses

Table 5.2 - Range of Driver Values that
Produce 10% Change in Overhead Recovered

<u>Cost Pool</u>	<u>Upper Bound</u>	<u>Lower Bound</u>
PEE	\$ 65.10 / hr	\$ 24.70 / hr
Shops	35.8 %	18.8 %
Materials	46.5 %	0 %
ROICC	81.0 %	0 %
HSG	\$ 766 / house	\$ 202 / house

Table 5.3 - Range of Overhead Rates that
Produce 10% Change in Overhead Recovered

Costs for FSC are not shown in Tables 5.2 and 5.3 because the rates were determined empirically. It was assumed that these rates will be set so as to fully recover all of the costs allocated to the FSC pool.

C. RECOMMENDATIONS

An overhead charge attempts to recoup the indirect costs associated with performing a specific action, usually billed to a reimbursable customer along with direct costs associated with that action. However, this is merely an educated guess and does not guarantee that all overhead costs will be recovered, or that they won't be over applied.

In the current case with PWO, they are only trying to recover the part of the overhead costs associated with reimbursable customers. A significant portion of the PWO workload is for NPS for which PWO will not be reimbursed, nor will it attempt to keep track of the associated overhead costs. Therefore, there will always be an unclear distinction between how much of the total PWO overhead costs should be borne by NPS and how much by reimbursable customers. The calculations in this thesis attempt to clarify that line.

1. Practical Application of Rates

Calculating rates is a straight forward procedure, having gathered the information and made the necessary assumptions. However, it is also necessary to step back and take a practical view of how to implement the overhead rates into practice. What is a practical rate that can be used and easily calculated, and to how many decimal places? How precise should PWO be to ensure accuracy, without overdoing it?

Rates that are calculated in dollar figures should not include cents, as the precision does not reflect the accuracy. This is because the cost driver, housing units or direct labor hours, is a very accurate figure. Rounding up or down to the nearest \$5 increment

provides a figure that is easy to remember and to calculate, and does not disproportionately allocate overhead.

The markup percentages are perhaps even less precise because they use a less accurately determined cost driver. Therefore, percentages should be rounded off to the nearest whole number (no decimal places). This does not provide as easy of a figure to remember in practice, but each branch of the organization will only have one applicable rate.

Table 5.4 lists the recommended overhead rates that should be used in practice. If these rates were applied, PWO would have failed to recover approximately \$17,000 of overhead costs, using the figures in this thesis. That is less than 0.2% of the total overhead costs, and is less than 4% of the combined costs of the G&A allocation to Others and the allocated vehicle costs to others -- neither of which will be recovered.

<u>Cost Pools</u>	<u>Overhead Rate</u>	<u>Cost Driver</u>
FSC		Markup per maximum value of contract
	16 %	first \$ 100,000
	11 %	next \$ 400,000
	6 %	next \$ 1,500,000
	3 %	remainder of costs
PEE	\$ 45	Cost per direct labor hour
Shops	27 %	Markup per direct labor cost
Materials	20 %	Markup per direct cost of materials
ROICC	3 %	Markup per estimated cost of contract
HSG	\$ 485	Cost per housing unit

Table 5.4 - Recommended Overhead Rates

Finally, the reader is reminded of the NavFac overhead charge that is added for FSC and ROICC contracts. Table 5.5 lists the overhead rates that incorporate the NavFac charge with the recommended rate. Care should be taken to ensure the reimbursable customer is aware of the total rate, to include NavFac charges.

<u>Cost Pools</u>	<u>Overhead Rate</u>	<u>Cost Driver</u>
FSC		Markup per maximum value of contract
	20 %	first \$ 100,000
	15 %	next \$ 400,000
	10 %	next \$ 1,500,000
	7 %	remainder of costs
ROICC		Markup per estimated cost of contract
	5 %	Design contracts
	11 %	Construction Contracts

Table 5.5 - Overhead Rates with NavFac Charges

2. Subjects for Further Research

Areas requiring further research are as follows:

- Better allocation methods for the vehicles that more accurately reflects the actual costs of operating and maintaining each type of vehicle.
- Any refinement of allocation of costs within a specific cost pool. The numbers should be fine tuned with more accurate data, if PWO begins to track where funds are spent in accordance with the cost pools identified.
- Determine the costs to maintain housing units and determine the allocation procedures necessary to develop a single unit cost per house for NPS to operate and maintain all of its housing units.
- Eventually, as the PWO organization grows, other areas should be broken out and treated as an individual cost pool, such as the environmental branch.
- Researching the costs associated with administering FSC contracts to see if a better method of allocation can be identified that would more fairly distribute actual overhead costs associated with the specific contract.

APPENDIX A. PWO BILLETS AND SALARIES

<u>BILLET #</u>	<u>POSITION</u>	<u>GRADE</u>	<u>SALARY w/FRINGES</u>
	Public Works Officer		
	Asst. PWO		
43A-27-OM	Prod Controller	GS-12/05	\$ 58,957
43D-01-RA	Deputy PWO	GS-14/09	\$ 93,352
43D-03-RA	Budget Asst	GS-07/02	\$ 30,550
43D-04-OM	Admin Officer	GS-11/04	\$ 48,136
43D-04-RA	Budget Asst	GS-07/04	\$ 32,521
43D-05-RA	Admin Spt Spec	GS-09/01	\$ 36,168
43D-06-OM	Admin Spt Asst	GS-06/01	\$ 26,607
43D-08-OM	Spv Fisc Analyst	GS-11/02	\$ 45,218
43D-11-OM	Budget Asst	GS-06/04	\$ 29,267
43D-20-OM	Admin Spt Asst	GS-05/04	\$ 26,259
43H-01-RA	Budget Assistant	GS-09	\$ 40,990
43T-01-OM	Env Prot Spec	GS-12/04	\$ 57,693
43T-02-OM	Env Prot Spec	GS-09/03	\$ 38,580
43T-03-OM	Env Prot Spec	GS-09/06	\$ 42,197
	Admin Spt Asst	GS-07/9	\$ 37,447
Total			\$ 643,948

General And Administrative Billets And Salaries

<u>BILLET #</u>	<u>POSITION</u>	<u>GRADE</u>	<u>SALARY w/FRINGES</u>
43A-04-OM	Motor Veh Oper	WG-06/00	\$ 44,532
43A-13-OM	Hvy Equ Mech Insp	WG-11/00	\$ 51,227
43A-14-RH	Laborer	WG-03/03	\$ 28,593
43A-29-OM	Eng Equip Oper	WG-08/05	\$ 40,433
43A-41-OM	Laborer	WG-03/00	\$ 37,835
43A-43-OM	Laborer	WG-03/05	\$ 30,706
43H-27-RA	Maint Mech	WG-09	\$ 38,505
43H-28-RA	Trans Asst	GS-05	\$ 27,055
43H-59-RA	Maint Mech	WG-10	\$ 40,224
43H-60-RA	Maint Mech	WG-10	\$ 40,224
43R-02-OM	Eng Equip Oper	WG-10/03	\$ 41,794
43R-03-OM	Auto Mechanic	WG-10/05	\$ 45,081
43T-01-RA	Auto Equip Insp	WG-11/05	\$ 46,694
43T-02-RA	Auto Mechanic	WG-10/04	\$ 43,100
43T-03-RA	Auto Mechanic	WG-10/05	\$ 44,717
43T-04-RA	Eng Equip Oper	WG-08/00	\$ 46,694
43T-05-RA	Hvy Equip Mech	WG-10/05	\$ 44,717
Total			\$ 692,139

Vehicles Billets And Salaries

<u>BILLET #</u>	<u>POSITION</u>	<u>GRADE</u>	<u>SALARY w/FRINGES</u>
	FSC Officer		
43A-09-OM	Contr Surv Rep	GS-10/10	\$ 50,034
43A-32-OM	Contr Surv Rep	GS-09/09	\$ 45,442
43B-01-RBR	QA Specialist (T)	GS-07/01	\$ 25,961
43B-02-RBR	Contract Spec	GS-09/10	\$ 47,020
43D-07-RA	Spv Eng Tech	GS-11/03	\$ 46,677
43D-13-OM	Contract Spec	GS-05/05	\$ 27,055
43D-14-RH(I)	Contract Spec	GS-11/07	\$ 52,511
43D-15-RA	Eng Tech	GS-09/00	\$ 50,457
43D-16-RA	Qa Spec	GS-07/00	\$ 37,109
43D-17-RA	Qa Spec	GS-07/09	\$ 37,447
43D-18-OM	Constructn Rep	GS-09/02	\$ 37,373
43D-19-OM	Qa Specialist	GS-07/00	\$ 42,197
43H-04-RA	Contract Specialist	GS-11	\$ 49,594
43H-05-RA	Cont Surv Rep	GS-09/04	\$ 39,785
43H-06-RA	Contract Spec	GS-09/05	\$ 40,990
	Contr Surv Rep	GS-11/09	\$ 54,978
Total			\$ 684,636

Facilities Support Contracts Billets And Salaries

<u>BILLET #</u>	<u>POSITION</u>	<u>GRADE</u>	<u>SALARY w/FRINGES</u>
43A-19-OM	Spvy Gen Eng	GS-12/09	\$ 65,893
43A-45-OM	Spv P/E	WN-07/05	\$ 62,966
43D-02-OM	Eng Tech	GS-09/00	\$ 56,886
43D-03-OM	Eng Tech	GS-09/10	\$ 47,020
43D-10-RA	Eng Tech/Cad	GS-09/00	\$ 50,618
43D-12-RH	Eng Tech	GS-11	\$ 49,594
43D-14-RA	Eng Tech	GS-09/00	\$ 53,969
43D-17-OM	Spv General Eng	GS-13/09	\$ 78,996

Project Estimating And Engineering Overhead Billets And Salaries

<u>BILLET #</u>	<u>POSITION</u>	<u>GRADE</u>	<u>SALARY w/FRINGES</u>
42D-11-RA	P/E	WD-08	\$ 52,315
42D-12-RA	Asst P/E	WD-06	\$ 48,850
43A-34-OM	P/E	WD-08/03	\$ 53,468
43A-52-OM	P/E	WD-08/05	\$ 57,645
43D-01-OM	P/E	WD-06/03	\$ 50,338
43D-07-OM	Electrical Eng	GS-12/05	\$ 62,230
43D-08-RA	Mech Engineer	GS-11/03	\$ 50,618
43D-09-OM	Mechanical Eng	GS-12/05	\$ 59,440
43D-09-RA	Electrical Eng	GS-11/05	\$ 54,835
43D-10-OM	P/E	WD-08/05	\$ 58,117
43D-12-OM	Civil Engineer	GS-11/07	\$ 56,241
43D-13-RA	P/E	WD-08/02	\$ 51,828
43D-13-RH(I)	General Eng	GS-11/06	\$ 54,835
43D-14-OM	Civil Engineer	GS-12/08	\$ 64,685
43H-02-RA	Civil Engineer	GS-11	\$ 49,594
43H-03-RA	Civil Engineer	GS-11/05	\$ 53,429
43H-18-RA	P/E	WD-08/05	\$ 58,117
43H-19-RA	Asst P & E	WD-06/00	\$ 68,180
Total			\$ 1,470,723

Project Estimating And Engineering Direct Labor Billets And Salaries

<u>BILLET #</u>	<u>POSITION</u>	<u>GRADE</u>	<u>SALARY w/FRINGES</u>
43D-01-RH	Hsg Mgt Spec	GS-09/03	\$ 38,580
43D-02-RH	Hsg Mgt Asst	GS-08/02	\$ 33,836
43D-03-RH	Hsg Manager	GS-12/10	\$ 68,181
43D-04-RH	Hsg Mgt Spec	GS-09/06	\$ 42,197
43D-05-RH	Hsg Mgt Spec	GS-11/04	\$ 48,136
43D-06-RH	Hsg Admin Spt Asst	GS-05/04	\$ 26,259
43D-07-RH	Budget Analyst	GS-09/02	\$ 37,373
43D-08-RH	Hsg Mgt Spec	GS-09/03	\$ 38,580
43D-09-RH	Hsg Mgt Asst	GS-05	\$ 27,055
43D-10-RH	Hsg Mgt Asst	GS-09	\$ 40,990
43D-11-RH	Hsg Mgt Spec	GS-11	\$ 49,594
43H-07-RA	Hsg Director	GS-13/02	\$ 64,447
43H-08-RA	Hsg Mgt Asst	GS-07/04	\$ 32,521
43H-09-RA	Hsg Mgt Asst	GS-07/04	\$ 32,521
43H-10-RA	Hsg Mgt Asst	GS-07/04	\$ 32,521
43H-11-RA	Hsg Manager	GS-09/04	\$ 39,785
43H-12-RA	Hsg Mgr/Counselr	GS-07/01	\$ 29,566
43H-13-RA	Hsg Mgt Asst	GS-07/02	\$ 30,550
43H-14-RA	Hsg Mgt Asst	GS-07/02	\$ 30,550
43H-15-RA	Hsg Mgt Asst	GS-05/10	\$ 31,036
43H-16-RA	Hsg Mgt Asst	GS-05/00	\$ 38,401
43H-17-RA	Budget Asst	GS-07/08	\$ 36,462
Total			\$ 849,150

Housing Administration Billets And Salaries

<u>BILLET #</u>	<u>POSITION</u>	<u>GRADE</u>	<u>SALARY W/ FRINGES</u>
43A-15-OM	Prod Controller	GS-11/04	\$47,745
43A-39-OM	Mat Expediter	WG-08/03	\$37,505
43A-46-OM	Prod Controller	GS-09/02	\$37,070
43A-56-OM	Purch Agent	GS-07/06	\$34,211
43A-56-RA	Prod Controller	GS-06/05	\$30,155
43A-67-RA	Prod Controller	GS-07/00	\$45,455
43D-05-OM	Prod Controller	GS-07/07	\$35,477
43D-16-OM	Prod Controller	GS-09/06	\$42,198
43H-26-RA	Prod Controller	GS-06/10	\$34,589
43H-57-RA	Prod Controller	GS-09	\$40,991
43H-58-RA	Purchase Agent	GS-09	\$40,991
Total			\$426,386

Material Purchasing Billets And Salaries

<u>BILLET #</u>	<u>POSITION</u>	<u>GRADE</u>	<u>SALARY w/FRINGES</u>
43D-02-RA	Computer Spec	GS-11/06	\$51,052
43D-06-RA	Ofc Autom Asst	GS-07/02	\$30,551
43D-15-OM	Computer Spec	GS-11/06	\$51,052
Total			\$132,656

ADP Billets And Salaries

<u>BILLET #</u>	<u>POSITION</u>	<u>GRADE</u>	<u>SALARY w/FRINGES</u>
43A-02-OM	Toolroom Mech	WG-05/05	\$34,627
43A-03-OM	Maint Spvr I	WS-12/05	\$60,777
43A-05-RH	Admin Asst	GS-07/03	\$31,280
43A-10-OM	Maint Spvr Ii	WS-15/04	\$66,148
43A-12-OM	Toolroom Mech Ldr	WL-08/03	\$41,273
43A-17-OM	Maint Spvr Ii	WS-16/00	\$73,939
43A-21-RH	Toolroom Mech	WG-08/01	\$34,602
43A-22-RH	Toolroom Mech	WG-07/05	\$38,447
43A-23-OM	Maint Spvr I	WS-12/00	\$67,778
43A-25-OM	Pw Superintendent	GS-13/09	\$78,355
43A-29-RH	Toolroom Mech	WG-08/05	\$40,433
43A-44-OM	Maint Spvr I	WS-11/05	\$58,994
43A-57-RA	Maint Spvr I	WS-10/00	\$63,457
43A-68-RA	Em Svc Dispatcher	GS-05	\$30,155
43A-71-RA	Maint Spvr I	WS-11/02	\$53,137
43C-01-RA	Mnt Spvr I/Util(Tm2)	WS-11/02	\$53,137
43D-22-RA	Em Svc Dispatcher	GS-04-05	\$30,155
43F-01-RDF	Maint Mech Ldr	WL-10/00	\$70,644
43H-20-RA	Asst Mnt Spvr Ii	WS-17/05	\$76,292
43H-21-RA	Hsg Maint Spvr Ii	WS-14/05	\$66,178
43H-41-RA	Maint Spvr I	WS-10/00	\$63,457
43R-01-OM	Maint Spvr I	WS-11/03	\$55,691
43R-05-OM	Trans Spec	GS-09/03	\$38,894
43T-07-RA	Mnt Spvr I/Trans	WS-11/00	\$72,878
Total			\$1,266,099

Shops Overhead Billets And Salaries

<u>BILLET #</u>	<u>POSITION</u>	<u>GRADE</u>	<u>SALARY w/FRINGES</u>
43A-01-OM	Electrician	WG-10/05	\$44,354
43A-01-RH	Carpenter	WG-09/05	\$42,368
43A-01-RT	Mat Handler	WG-06/05	\$36,588
43A-02-RH	Maint Worker	WG-08/05	\$40,433
43A-02-RT	Laborer	WG-03/00	\$38,447
43A-03-RH	A/C Equip Mech	WG-11/05	\$46,315
43A-03-RT	Laborer	WG-03/00	\$32,591
43A-04-RH	Maint Mechanic	WG-09/00	\$49,140
43A-04-RT	Laborer	WG-03/02	\$27,422
43A-05-OM	Electrician	WG-10/05	\$44,354
43A-05-RT	Prod Controller	GS-06/00	\$34,669
43A-06-OM	Electrician	WG-11/05	\$46,315
43A-06-RH	Carpenter	WG-09/05	\$42,368
43A-07-OM	Locksmith	WG-09/05	\$42,368
43A-07-RH	Locksmith	WG-09/05	\$42,368
43A-08-OM	Maint Worker	WG-08/03	\$37,505
43A-08-RH	Maint Mech Ldr	WL-10/04	\$47,002
43A-09-RH	Maint Mechanic	WG-09/03	\$39,363
43A-10-RH	A/C Equip Mech	WG-08/05	\$40,433
43A-11-OM	Maint Worker	WG-08/05	\$40,433
43A-11-RH	A/C Equip Mech	WG-10/03	\$41,120
43A-12-RH	Electrician	WG-10/05	\$44,354
43A-13-RH	Maint Mechanic	WG-09/05	\$42,368
43A-14-OM	Maint Mechanic	WG-10/05	\$44,354
43A-15-RH	Painting Worker	WG-07/05	\$38,447
43A-16-OM	Gardner	WG-06/05	\$36,588
43A-16-RH	Maint Worker	WG-08/05	\$40,433

Shops Direct Labor Billets And Salaries

<u>BILLET #</u>	<u>POSITION</u>	<u>GRADE</u>	<u>SALARY w/FRINGES</u>
43A-17-RH	General Helper	WG-05/00	\$35,264
43A-18-OM	Gardner Leader	WL-06/04	\$39,147
43A-18-RH	Laborer	WG-03/05	\$30,706
43A-19-RH	Maint Mech Ldr	WL-10/04	\$47,002
43A-20-OM	Maint Mechanic	WG-10/00	\$69,943
43A-20-RH	Maint Mechanic	WG-11/05	\$46,315
43A-21-OM	Elevator Mech	WG-12/05	\$48,096
43A-22-OM	General Helper	WG-05/00	\$38,447
43A-23-RH	Maint Mechanic	WG-09/00	\$44,354
43A-24-OM	Maint Mech Ldr	WL-10/00	\$68,008
43A-24-RH	Carpenter	WG-09/05	\$42,368
43A-25-RH	Carpenter	WG-09/05	\$42,368
43A-26-OM	Pipefitter	WG-10/05	\$44,354
43A-26-RH	Maint Worker	WG-08/05	\$40,433
43A-27-RH	Electrician	WG-10/05	\$44,354
43A-28-OM	Gardner	WG-06	\$35,493
43A-28-RH	Maint Worker	WG-08/02	\$36,105
43A-29-RH	Toolroom Mech	WG-08/05	\$40,433
43A-30-OM	Maint Mechanic	WG-10/05	\$44,354
43A-31-OM	Ac Equip Mech	WG-10/05	\$44,354
43A-32-RA	Electrician	WG-10/00	\$54,420
43A-33-OM	Dig Comp Mech	WG-12/05	\$48,096
43A-35-OM	Gardner	WG-04/00	\$34,627
43A-36-OM	Woodworkr Ldr	WL-05/04	\$36,716
43A-37-OM	Laborer	WG-03/05	\$30,706
43A-38-OM	Maint Worker	WG-08/05	\$40,433
43A-40-OM	Maint Mechanic	WG-09/00	\$44,354
43A-42-OM	General Helper	WG-05/00	\$50,464

Shops Direct Labor Billets And Salaries (continued)

<u>BILLET #</u>	<u>POSITION</u>	<u>GRADE</u>	<u>SALARY w/FRINGES</u>
43A-42-RA	Carpenter	WG-09/04	\$41,252
43A-44-RA	Locksmith	WG-09/05	\$42,715
43A-47-OM	Electrician	WG-11/05	\$46,315
43A-47-RA	Carpenter	WG-09/00	\$58,118
43A-48-OM	Plumber	WG-09/05	\$42,368
43A-48-RA	Carpenter	WG-09	\$38,505
43A-49-OM	Laborer	WG-03/05	\$30,706
43A-49-RA	Electrician	WG-10/00	\$48,747
43A-50-OM	Carpenter	WG-09/04	\$40,916
43A-50-OM	Carpenter	WG-09/04	\$40,916
43A-50-RA	Electrician	WG-10/00	\$58,399
43A-51-OM	Plumber	WG-09/03	\$39,363
43A-51-RA	A/C Equip Mechanic	WG-08/00	\$44,718
43A-52-RA	Pipefitter	WG-10/05	\$44,718
43A-53-OM	Electrician	WG-11/00	\$63,780
43A-53-RA	Pipefitter	WG-10/00	\$55,704
43A-54-OM	Laborer	WG-03/00	\$43,306
43A-54-RA	Pipefitter	WG-10/00	\$61,044
43A-55-OM	Gardner	WG-04/00	\$37,454
43A-55-RA	Plumber	WG-09	\$38,505
43A-57-OM	General Helper	WG-05/05	\$34,627
43A-58-OM	Maint Worker	WG-08/03	\$37,505
43A-58-RA	Maint Mechanic	WG-09/05	\$42,715
43A-59-OM	Pipefitter	WG-10	\$43,029
43A-59-RA	Maint Mechanic	WG-09/05	\$42,715
43A-60-RA	Maint Mechanic	WG-09/05	\$42,715
43A-61-RA	Mat Handler	WG-05/00	\$40,765
43A-62-RA	Maint Worker	WG-08/00	\$41,252

Shops Direct Labor Billets And Salaries (continued)

<u>BILLET #</u>	<u>POSITION</u>	<u>GRADE</u>	<u>SALARY w/FRINGES</u>
43A-63-RA	Maint Worker	WG-08/00	\$42,715
43A-64-RA	Maint Worker	WG-08/00	\$41,252
43A-65-RA	Maint Worker	WG-08	\$36,682
43A-66-RA	Maint Worker	WG-08	\$36,682
43A-69-RA	Boiler Plant Op	WG-10/05	\$48,717
43A-70-RA	Boiler Plant Ldr	WL-10/00	\$56,883
43A-72-RA	Maint Mech	WG-10/05	\$44,718
43A-73-RA	Maint Mech	WG-10	\$40,225
43A-74-RA	Maint Mech	WG-10	\$40,225
43A-75-RA	Maint Mech	WG-10	\$40,225
43A-76-RA	Maint Mech	WG-10	\$40,225
43A-77-RA	Maint Mech	WG-10	\$40,225
43A-78-RA	Maint Mech	WG-10	\$40,225
43A-79-RA	Maint Mech	WG-10	\$40,225
43A-80-RA	Maint Mech	WG-09	\$41,457
43A-81-RA	Laborer	WG-03/02	\$36,016
43A-82-RA	Maint Mech Ldr	WL-10/04	\$47,387
43B-03-RBR	Gen Helper (Tm2)	WG-05	\$31,369
43B-04-RBR	Gen Helper (Tm2)	WG-05	\$31,369
43B-05-RBR	Maint Worker (Tm2)	WG-08/01	\$34,885
43B-06-RBR	Maint Worker (Tm2)	WG-08/01	\$34,885
43B-07-RBR	Maint Worker (Tm2)	WG-08	\$36,682
43B-08-RBR	Mnt Mech Ldr (Tm2)	WL-10/01	\$42,099
43C-01-OM	Boiler Plant Op	WG-10/05	\$49,081
43C-02-OM	Boiler Plant Op	WG-10/05	\$49,081
43C-02-RA	Hv Electrician	WG-11/05	\$46,694
43C-03-OM	Boiler Plant Op	WG-10/05	\$49,081
43C-03-RA	Hv Electrician	WG-11/02	\$41,611

Shops Direct Labor Billets And Salaries (continued)

<u>BILLET #</u>	<u>POSITION</u>	<u>GRADE</u>	<u>SALARY w/FRINGES</u>
43C-04-OM	Boiler Plant Op	WG-10/05	\$49,081
43C-04-RA	Boilr Equ Mech (T)	WG-10/02	\$35,027
43C-05-OM	Boiler Plant Op	WG-10/04	\$47,305
43C-05-RA	Electrician (T)	WG-10/02	\$35,027
43C-06-OM	Boiler Plant Op	WG-10/05	\$49,081
43C-06-RA	Pipefitter (Tm2)	WG-10/02	\$39,891
43C-07-RA	Maint Mech (Tm2)	WG-09/01	\$36,656
43C-08-RA	Maint Mech (T)	WG-10/05	\$39,264
43C-09-RA	Plumber (Tm2)	WG-09/01	\$36,656
43C-10-RA	Watr Trtmt Plnt Op	WG-10/05	\$44,718
43C-11-RA	Watr Trtmt Plnt Op	WG-10/05	\$44,718
43C-12-RA	Watr Trtmt Plnt Op	WG-10/05	\$44,718
43C-13-RA	Watr Trtmt Plnt Op	WG-10/05	\$44,718
43C-14-RA	Maint Worker (Tm2)	WG-08/01	\$33,859
43C-15-RA	Maint Worker (Tm2)	WG-08/01	\$33,859
43C-16-RA	Maint Worker (Tm2)	WG-08/01	\$33,859
43C-17-RA	Eng Equip Oper (Tm2)	WG-08/04	\$39,275
43C-18-RA	Electronics Mech (T)	WG-10/02	\$35,027
43C-19-RA	Welder (Tm2)	WG-11/02	\$36,536
43C-20-RA	Carpenter (Tm2)	WG-09	\$32,524
43C-21-RA	Tractor Oper (Tm2)	WG-06/02	\$32,832
43C-22-RA	Laborer (Tm2)	WG-03/05	\$30,958
43C-23-RA	Laborer (T)	WG-03/02	\$24,275
43C-24-RA	Laborer (Tm2)	WG-03/01	\$26,492
43D-23-RA	Carpenter	WG-07/04	\$37,426
43D-24-RA	Hv Electrician	WG-10/05	\$44,718
43D-25-RA	Laborer	WG-03/05	\$30,958
43D-26-RA	Maint Mechanic	WG-09/05	\$42,715

Shops Direct Labor Billets And Salaries (continued)

<u>BILLET #</u>	<u>POSITION</u>	<u>GRADE</u>	<u>SALARY w/FRINGES</u>
43D-27-RA	Maint Mechanic	WG-09/00	\$44,718
43D-28-RA	Maint Mechanic	WG-09/05	\$42,715
43D-29-RA	Maint Worker	WG-08/00	\$42,715
43D-30-RA	Painting Worker	WG-07/00	\$42,715
43D-31-RA	Pipefitter	WG-10/00	\$70,516
43D-33-RA	Hv Electrician	WG-11/00	\$52,573
43D-34-RA	Hv Electrician	WG-11/04	\$44,974
43D-35-RA	Hv Electrician	WG-10/00	\$48,747
43D-36-RA	A/C Equip Mechanic	WG-10/05	\$44,718
43D-37-RA	A/C Equip Mechanic	WG-08/00	\$44,718
43D-38-RA	Maint Worker	WG-08	\$36,682
43D-39-RA	Maint Mech	WG-09	\$38,505
43D-40-RA	Maint Mech	WG-09	\$38,505
43D-41-RA	Maint Mech	WG-09	\$38,505
43D-43-RA	Electrician	WG-10/00	\$45,873
43D-45-RA	Maint Worker	WG-08/00	\$42,715
43D-46-RA	Pipefitter	WG-10/00	\$48,747
43F-02-RDF	Elevator Mech	WG-08/02	\$36,401
43F-03-RDF	Boiler Plant Op(Tm2)	WG-10/03	\$45,165
43F-04-RDF	Boiler Plant Op(Tm2)	WG-10	\$45,165
43F-04-RDF	Boiler Plant Op(Tm2)	WG-10	\$45,165
43F-05-RDF	Boiler Plant Op(Tm2)	WG-10/01	\$41,697
43F-06-RDF	Boiler Plant Op(Tm2)	WG-10/02	\$43,459
43F-07-RDF	A/C Equip Mech (Tm2)	WG-10	\$40,225
43F-08-RDF	Electrician (Tm2)	WG-10	\$36,682
43F-09-RDF	Maint Mech (Tm2)	WG-09/01	\$36,656
43F-10-RDF	Maint Mech (Tm2)	WG-09/01	\$36,656
43H-25-RA	Maint Mech	WG-09	\$38,505

Shops Direct Labor Billets And Salaries (continued)

<u>BILLET #</u>	<u>POSITION</u>	<u>GRADE</u>	<u>SALARY w/FRINGES</u>
43H-26-RA	Maint Mech	WG-09	\$38,505
43H-27-RA	Prod Controller	GS-06/00	\$40,980
43H-28-RA	Toolrm Mech	WG-06/00	\$46,694
43H-29-RA	Carpenter	WG-09/00	\$50,878
43H-30-RA	Painting Worker	WG-07/00	\$62,430
43H-31-RA	Carpenter	WG-09/00	\$49,415
43H-32-RA	Carpenter	WG-09/00	\$54,009
43H-33-RA	Carpenter	WG-09	\$38,505
43H-34-RA	Carpenter	WG-09	\$38,505
43H-35-RA	Electrician	WG-10/00	\$48,747
43H-36-RA	Electrician	WG-10/05	\$44,718
43H-36-RA	Electrician	WG-10/05	\$44,718
43H-37-RA	Electrician	WG-10/00	\$48,747
43H-38-RA	General Helper	WG-05/05	\$34,911
43H-39-RA	Laborer	WG-03/05	\$30,958
43H-40-RA	Locksmith	WG-09/05	\$42,715
43H-42-RA	Maint Mechanic	WG-09/05	\$42,715
43H-43-RA	Maint Mechanic	WG-09/00	\$44,718
43H-44-RA	Maint Mechanic	WG-09/05	\$42,715
43H-45-RA	Maint Worker	WG-08/00	\$42,715
43H-46-RA	Maint Worker	WG-08/00	\$62,224
43H-47-RA	Maint Worker	WG-08/00	\$44,718
43H-48-RA	Maint Worker	WG-08/00	\$42,715
43H-48-RA	Maint Worker	WG-08/00	\$42,715
43H-49-RA	Maint Worker	WG-08/00	\$42,715
43H-50-RA	Mat Handler	WG-05/00	\$44,718
43H-51-RA	Plumber	WG-09/00	\$64,303
43H-52-RA	Plumber	WG-09/00	\$50,878

Shops Direct Labor Billets And Salaries (continued)

<u>BILLET #</u>	<u>POSITION</u>	<u>GRADE</u>	<u>SALARY w/FRINGES</u>
43H-53-RA	Plumber	WG-09/00	\$45,873
43H-54-RA	Plumber	WG-09	\$38,505
43H-55-RA	Plumber	WG-09	\$38,505
43H-56-RA	Toolrm Mech	WG-06/00	\$51,494
43R-04-OM	Power Sys Mech	WG-10/04	\$43,451
43T-06-RA	Laborer	WG-03/05	\$30,958
Total			\$8,492,328

Shops Direct Labor Billets And Salaries (continued)

APPENDIX B. SPREADSHEET FOR SENSITIVITY ANALYSIS

<u>Overhead Costs</u>		<u>Direct Costs</u>	
Training	\$ 123,250	Shops Direct	\$ 8,536,682
Office Supplies	\$ 101,600	Mat Purchases	\$ 2,778,709
ADP	\$ 342,656	FSC contracts	\$ 7,114,146
Vehicles	\$ 918,454	ROICC contracts	\$ 931,559
G&A	\$ 785,948	Others	\$ 4,645,197
Shops Admin Labor	\$ 1,300,726		
Mat Admin Labor	\$ 426,386	Total	\$ 24,006,293
HSG	\$ 1,118,050		
FSC Admin Labor	\$ 684,636		
PEE Labor	\$ 1,470,723		
Total	\$ 7,272,429	Grand Total	\$ 31,278,722

AS ORIGINALLY CALCULATED

<u>Cost Pool (Driver)</u>	<u>Driver Amount</u>	<u>Overhead Rate</u>	<u>Overhead</u>
FSC (contracts)	\$ 7,114,146	14.56 %	\$ 1,035,826
PEE (dir lab hrs)	36,000	\$ 44.90	\$ 1,616,527
Shops (dir lab costs)	\$ 8,536,682	27.29 %	\$ 2,329,239
Mat (cost of mat)	\$ 2,778,709	20.28 %	\$ 563,463
HSG (# units)	2,579	\$ 484	\$ 1,248,922
ROICC (ECC)	\$ 931,559	2.96 %	\$ 27,535
Utilities	\$ 4,645,197	2.96 %	\$ 137,304
Misc unrecovered (veh)			\$ 313,613
		Total	\$ 7,272,429
		Should be	\$ 7,272,429
		Difference	\$ 0
		Percent Change	0.00 %

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